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# MINI-FERTILIZER PLANT PROJECTS
# APPENDICES

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Preface

This document constitutes the appendices to the study "Mini Fertilizer Projects, Volume I" and contains apart from details regarding the sources of information, statistical material concerning the development of fertilizer consumption and special sections on the methodology of evaluation, the raw material potential in developing countries, as well as potential users of mini fertilizer plants.

CONTENTS


| | | Page |
|---|---|---|
| APPENDIX | | |
| 1/1 | Sources of information for the study | 6 |
| 2/1 | Development of world fertilizer consumption 1975/76 - 1980/81 | 9 |
| 3/1 | Methods used for economic evaluation in the study | 12 |
| 3/2 | Brief introduction to the use of of mathematical programming | 117 |
| 4/1 | Fertilizer consumption in developing countries in 1976/77 and 1981/82 | 134 |
| 4/2 | Classification of developing countries according to tneir fertilizer consumption | 174 |
| 4/3 | Raw material potential in developing countries | 176 |
| 4/4 | Potential users of mini-fertilizer plants | 201 |

Appendix 1/1
Information Sources

| | | |
|---|---|---|
| 1. | Reply to questionnaires from contractors and process owners | 6 |
| 2. | Reply to questionnaires from plant owners in developing countries | 6 |
| 3. | Direct contacts | 7 |
| 3.1 | Contractors and process owners | 7 |
| 3.2 | FAO information material received in Rome | 7 |
| 4. | UNIDO information material | 7 |
| 5. | Lahore seminar | 8 |

Page

6. Technical conference on ammonia fertilizer technology for promotion of economic coopertation among developing countries. Beijing. 8

7. Others 8

Appendix 2/1
Development of World Fertilizer Consumption

Table 1 World consumption of fertilizers, by regions 1975/76 - 1980/81 9

Table 2 World fertilizer consumption growth rates, by regions 1975/76 - 1980/81 10

Appendix 3/1
Methods used for economic evaluation in the study

Method of economic evaluation 12

Table 1-1.1-18 Total investment costs of N plants 32-49

Table 1-2.1-6 Total investment costs of $P_2O_5$ plants 50-55

Table 2-1 Specific investment costs of N products 56

Table 2-2 Specific investment costs of $P_2O_5$ products 57

Table 3-1.1 Total investment costs of ammonia-urea complexes 58

Table 3-1.2 Total investment costs of ammonia-nitric acid-ammonium-nitrate complexes 59

Table 3-2 Total investment costs of phosphate complexes 60

Table 4-1.1 Specific investment costs of N fertilizer complexes 61

Table 4-1.2 Specific investment costs per ton N in N fertilizer complexes 62

| | | Page |
|---|---|---|
| Table 4-2 | Specific investment costs of phosphate complexes | 63 |
| Table 5-1.1-36 | Production costs of N products | 64-99 |
| Table 5-2.1-9 | Production costs of $P_2O_5$ products | 100-108 |
| Table 6-1.1-2 | Product values at factory gate of N products based on natural gas, per ton product and per ton N | 109-110 |
| Table 6-1.2 | Product values at factory gate of N products based on fuel oil | 111 |
| Table 6-1.3 | Product values at factory gate of N products based on coal | 112 |
| Table 6-2 | Product values at factory gate of $P_2O_5$ products | 113 |
| Table 7-1.1-2 | Farm gate prices of N products, per ton product and per ton N | 114-115 |
| Table 7-2 | Farm gate prices of $P_2O_5$ products | 116 |

Appendix 3/2
A brief introduction to the use of mathematical programming in economic decision making 117

Appendix 4/1
Fertilizer consumption in developing countries in 1976/77 and 1981/82

| | | |
|---|---|---|
| Table 1/1-7 | N consumption in developing countries by categories in 1976/77 and 1981/82 | 134-149 |
| Table 2/1-6 | $P_2O_5$ consumption in developing countries by categories in 1976/77 and 1981/82 | 150-162 |
| Table 3/1-6 | $K_2O$ consumption in developing countries by categories in 1976/77 and 1981/82 | 163-173 |

Page

Appendix 4/2
Classification of developing countries

according to their fertilizer consumption


| | | |
|---|---|---|
| Table 1 | Countries according to their annual consumption of fertilizers | 174 |
| Table 2 | Countries according to their per hectare consumption of fertilizers | 175 |


Appendix 4/3
Raw material potential in developing countries


| | | |
|---|---|---|
| Table 1 | Production of natural gas and reserves in the developing countries | 176 |
| Table 2 | Crude oil production, reserves and refining capacities in the developing countries | 180 |
| Table 3 | Coal production and reserves in the developing countries | 184 |
| Table 4 | Production of phosphate rock and reserves in the developing countries | 187 |
| Table 5 | Production of potash and reserves in the developing countries | 191 |
| Table 6 | Production of sulphur in-all-forms and reserves in the developing countries in 1981 | 193 |
| Table 7 | Raw material potential for fertilizer production in developing countries studied /1983/ | 197 |

Page

Appendix 4/4
Potential users of mini-fertilizer plants


| | | |
|---|---|---|
| Table 1 | Potential users of mini N fertilizer plants | 201 |
| Table 2 | Potential users of mini $P_2O_5$ fertilizer plants | 204 |

Appendix 1/1 - Sources of information for the study

1. Reply to questionnaires from contractors and process owners:

Positive answers received from:

C.F. Braun and Co.
John Brown Engineers and Construction Ltd
Haldor Topsoe
Krupp-Koppers GmbH
Société Chimique de la Grand Paroisse
Sim-Chem Ltd
Snamprogetti S.p.A.
Uhde GmbH
Voest Alpine

Negative answers:

Five companies returned negative answers.

No answer:

Twenty-six companies did not reply.

2. Reply to questionnaires from plant owners in developing countries:

Answers:

Fertilizantes Nitrogenados do Nordeste St. Salvador
Azot Sanayii T.A.S. Turkey
Chemical Company of Malaysia Berhad. Malaysia
National Agricultural Chemicals and Fertilizer Ltd, Kenya

No answer:

Twenty-five companies did not return questionnaires.

Appendix 1/1

3. Direct contacts

3.1 Contractors and process owners:

Haldor Topsoe A/S, Copenhagen, Denmark

Humphreys and Glasgow Ltd, London, England

Imperial Chemical Industries (ICI), Billingham, England

Krupp-Koppers GmbH, Essen, Germany

KTI-Kinetics Technologie, Holland

Société Chimique de la Grand Paroisse, Paris, France

Uhde GmbH, Dortmund, Germany

Voest-Alpine AG, Linz, Austria

3.2 Information material supplied by FAO, Rome:

a. Information issued by FAO:

Fertilizer Yearbook 1981

Agriculture toward 2000

Input requirements: Production, consumption, export/import figures from fertilizer year 1970/71 to 81/82, by nutrients and by type of fertilizers

Data of land use, by countries, 1971-1981

Current world fertilizer situation and outlook 1980/81-1986/87

Commission on fertilizers, eighth session, Rome, 31 January to 3 February, 1983

b. Information issued by Bureau of Mines:

Minerals Yearbook, 1981 (US Dept. of Interior) reprints

potash
sulphur
phosphate rock

4. UNIDO information material:

Internal working papers:

Opportunities for establishment of mini fertilizer plants in developing countries

Potential for setting up mini fertilizer plants

World fertilizer situation 1975-1981 and outlook in the 1980s

Market study for mini fertilizer plants for developing countries

Appendix 1/1

5. Lahore Seminar

The seminar on mini fertilizer plants was organized by UNIDO, 15 - 20 November, 1982. Forty-five papers were presented. Out of these, 19 came from industrialized, 26 from developing countries. Thirty dealt with processes (out of these 11 presented new technological aspects) and 18 dealt with financial problems.

6. Technical conference on ammonia fertilizer technology for promotion of economic co-operation among developing countries, Beijing

The conference was organized by UNIDO, 13-28 March, 1982. Thirty-seven papers were presented. Seven of these come from industrialized and 30 from developing countries.

7. Others

Fertilizer Manual, UNIDO, Development and Transfer of Technology Series No. 13, ID/250, 1980

British Sulphur Corporation International Conference 1977, 1978

Fertilizer Industry, Noyes Data Corporation, New Jersey, USA, 1979

The Nitrogen Industry, edited by G.D. Honti, Budapest, 1976

Ammonia and Synthesis Gas, recent and energy-saving processes, edited by F.J. Brykowski, Noyes Data Corporation, New Jersey, USA, 1981

Second world-wide study on the fertilizer industry: 1975-2000, UNIDO/ICIS.81, 1978

International Petroleum Encyclopedia 1978, The Petroleum Publishing Co., Tulsa, USA

World Fertilizer Atlas, Sixth Edition, The British Sulphur Corporation Ltd., 1979

Phosphoric Acid, Outline of the Industry, The British Sulphur Corporation Ltd., 1980

Appendix 2/1

Table 1. World Consumption of Fertilizers, by Regions 1975/76-1980/81
/Million metric tons N - $P_2O_5$ - $K_2O$/

| Region | Nitrogenous | | | | | | Phosphate | | | | | | Potash | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1975/76 | 76/77 | 77/78 | 78/79 | 79/80 | 80/81 | 1975/76 | 76/77 | 77/78 | 78/79 | 79/80 | 80/81 | 1975/76 | 76/77 | 77/78 | 78/79 | 79/80 | 80/81 |
| **Developed Market Economies** | **19,2** | **19,9** | **19,8** | **21,4** | **22,7** | **22,8** | **12,2** | **13,4** | **13,1** | **14,2** | **14,2** | **13,5** | **10,5** | **11,6** | **11,5** | **12,6** | **12,8** | **12,2** |
| North America | 10,0 | 10,2 | 9,7 | 10,6 | 11,2 | 11,6 | 5,2 | 5,6 | 5,2 | 5,7 | 5,5 | 5,5 | 5,0 | 5,5 | 5,3 | 6,0 | 6,0 | 6,0 |
| Western Europe | 8,0 | 8,4 | 8,8 | 9,4 | 10,0 | 9,8 | 5,1 | 5,5 | 5,6 | 6,1 | 6,1 | 5,6 | 4,6 | 5,0 | 5,2 | 5,5 | 5,7 | 5,3 |
| Oceania | 0,18 | 0,22 | 0,24 | 0,24 | 0,26 | 0,27 | 0,88 | 1,11 | 1,18 | 1,28 | 1,32 | 1,2 | 0,19 | 0,23 | 0,23 | 0,25 | 0,24 | 0,22 |
| Others | 0,98 | 1,05 | 1,10 | 1,14 | 1,22 | 1,12 | 1,00 | 1,12 | 1,15 | 1,20 | 1,26 | 1,16 | 0,72 | 0,79 | 0,82 | 0,87 | 0,88 | 0,67 |
| **Developing Market Economies** | **7,3** | **8,49** | **9,57** | **10,1** | **11,3** | **11,97** | **3,8** | **4,55** | **5,15** | **5,56** | **6,00** | **6,54** | **1,82** | **2,18** | **2,6** | **2,90** | **3,07** | **3,45** |
| Africa | 0,44 | 0,47 | 0,47 | 0,49 | 0,55 | 0,69 | 0,36 | 0,4 | 0,38 | 0,39 | 0,39 | 0,52 | 0,19 | 0,20 | 0,22 | 0,23 | 0,22 | 0,25 |
| Latin America | 1,88 | 2,26 | 2,51 | 2,46 | 2,67 | 2,84 | 1,70 | 2,0 | 2,21 | 2,29 | 2,44 | 2,76 | 0,93 | 1,12 | 1,39 | 1,48 | 1,58 | 1,86 |
| Near East | 1,32 | 1,39 | 1,56 | 1,64 | 1,81 | 1,82 | 0,69 | 0,84 | 0,96 | 0,37 | 1,13 | 1,05 | 0,03 | 0,04 | 0,04 | 0,05 | 0,06 | 0,08 |
| Far East | 3,70 | 4,35 | 5,0 | 5,5 | 6,24 | 6,61 | 1,07 | 1,29 | 1,59 | 1,31 | 2,04 | 2,21 | 0,65 | 0,81 | 0,93 | 1,14 | 1,20 | 1,26 |
| Others | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,01 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| **Centrally Planned Economies** | **16,3** | **16,5** | **20,4** | **22,2** | **23,3** | **22,52** | **9,1** | **9,4** | **10,23** | **10,80** | **10,87** | **11,43** | **9,1** | **9,3** | **8,8** | **8,9** | **8,1** | **8,6** |
| Asia | 4,8 | 5,2 | 8,7 | 10,03 | 11,3 | 12,83 | 1,48 | 1,57 | 2,09 | 2,32 | 2,21 | 2,92 | 0,40 | 0,41 | 0,25 | 0,37 | 0,51 | 0,58 |
| Eastern Europe | 11,5 | 11,3 | 11,7 | 12,19 | 12,0 | 12,69 | 7,61 | 7,82 | 8,14 | 8,48 | 8,66 | 8,51 | 8,75 | 8,9 | 8,5 | 8,6 | 7,6 | 8,00 |
| **All Developed Countries** | **30,7** | **31,3** | **31,5** | **33,6** | **34,7** | **35,5** | **19,8** | **21,2** | **21,3** | **22,7** | **22,9** | **22,0** | **19,2** | **20,5** | **20,0** | **21,2** | **20,4** | **20,2** |
| **All Developing Countries** | **12,1** | **13,7** | **18,3** | **20,1** | **22,6** | **24,8** | **5,3** | **6,1** | **7,2** | **7,9** | **8,2** | **9,5** | **2,2** | **2,6** | **2,9** | **3,2** | **3,6** | **4,0** |
| **World Total** | **42,9** | **45,0** | **49,8** | **53,7** | **57,3** | **60,3** | **25,2** | **27,3** | **28,5** | **30,6** | **31,1** | **31,5** | **21,4** | **23,1** | **22,9** | **24,4** | **24,0** | **24,20** |

Sources: FAO Fertilizer Yearbooks 1979, 1980, 1981
FAO /UNIDO/ World Bank Working Group on Fertilizers, June 1982

Appendix 2/1

Table 2. World Fertilizer Consumption Growth Rates, by Regions
1975/76-1980/81

| Region | 1976/77 | 77/78 | 78/79 | 79/80 | 80/81 |
|---|---|---|---|---|---|
| | N I T R O G E N | | | | |
| | Annual growth rates /per cent/ | | | | |
| All developed countries | 1,9 | 0,6 | 6,7 | 3,3 | 2,3 |
| North America | 2,0 | -5,2 | 9,3 | 5,7 | 3,6 |
| Western Europe | 5,0 | 4,8 | 6,8 | 6,4 | -2,0 |
| Eastern Europe | -1,7 | 3,5 | 4,2 | -1,6 | 5,7 |
| All developing countries | 13,2 | 33,5 | 9,8 | 12,4 | 9,7 |
| Africa | 6,8 | 0,0 | 4,3 | 12,2 | 25,5 |
| Latin America | 20,2 | 11,1 | -2,0 | 8,5 | 6,4 |
| Near East | 12,9 | 4,7 | 5,1 | 10,4 | 0,6 |
| Far East x/ | 11,1 | 45,0 | 11,7 | 14,6 | 10,8 |
| World Total | 4,9 | 10,7 | 7,8 | 6,7 | 5,2 |
| | P H O S P H A T E | | | | |
| All developed countries | 7,1 | 0,5 | 6,6 | 0,9 | -4,1 |
| North America | 7,7 | -7,7 | 9,6 | -3,6 | 0,0 |
| Western Europe | 7,8 | 1,8 | 8,9 | 0,0 | -8,9 |
| Eastern Europe | 2,8 | 4,1 | 4,2 | 2,1 | -1,8 |

x/ Including Asia from Centrally Planned Economies

Table 2 /cont'd/

| | P H O S P H A T E /cont'd/ | | | | |
|---|---|---|---|---|---|
| | Annual growth rates /per cent/ | | | | |
| | 1976/77 | 1977/78 | 1978/79 | 1979/80 | 1980/81 |
| All developing countries | 15,1 | 18,0 | 9,7 | 3,8 | 15,9 |
| Africa | 11,1 | -5,3 | 2,6 | 0,0 | 33,3 |
| Latin America | 17,6 | 10,5 | 3,6 | 7,0 | 13,1 |
| Near East | 21,7 | 14,3 | 1,0 | 16,5 | 7,6 |
| Far East x/ | 12,? | 28,7 | 14,9 | 0,5 | 20,7 |
| World Total | 8,3 | 4,4 | 7,4 | 1,6 | 1,3 |
| | P O T A S H | | | | |
| All developed countries | 6,8 | -2,5 | 6,0 | -3,9 | -1,0 |
| North America | 10,0 | -3,8 | 13,2 | 0,0 | 0,0 |
| Western Europe | 8,7 | 4,0 | 5,8 | 3,6 | -7,0 |
| Eastern Europe | 1,7 | -4,7 | 1,2 | -13,2 | 11,1 |
| All Developing countries | 18,2 | 11,5 | 10,3 | 12,5 | 11,1 |
| Africa | 5,3 | 10,0 | 4,5 | -4,5 | 13,6 |
| Latin America | 20,4 | 24,1 | 6,5 | 6,8 | 17,0 |
| Near East | 33,3 | 0,0 | 25,0 | 20,0 | 33,3 |
| Far East x/ | 16,2 | -3,4 | 28,0 | 13,2 | 7,6 |
| World Total | 7,9 | -0,9 | 6,6 | -1,7 | 0,8 |

Source: FAO Fertilizer Yearbook, 1981.

FAO /UNIDO/ World Bank Working Group on Fertilizers, June 1982.

x/ Including Asia from Centrally Planned Economies

Appendix 3/1 - Methods used for economic evaluation in the study

(Comparison of investment and production cost for mini and big plants

- in a developed site (West-Europe)
- in developing sites (seaside and remote location)

Introduction

If an economic comparison is made of ammonia production e.g. in a large single train plant (1000-1500 tpd) with a smaller plant (say, 200 tpd) and considering only technical factors then the conclusion may well be reached that the specific production cost per ton of product is lower in the larger plant. This will be due to the economies of scale in equipment costs and increased energy efficiencies. However, such comparisons ignore a number of factors and possible external constraints which will affect the plant's construction and operation and thereby alter the true economics of production.

Smaller capacity plants are quicker to build and will generally reach their design output in a much shorter time after initial plant start-up. The time saved may well be 2-3 years in total. Longer construc-

tion time means higher costs of pre-operating interest and a deferment of the date when natural resources or locally available feedstocks can be profitably converted into product and markets can begin to be satisfied. Meeting the technical and infrastructure needs of a large plant can also impose undue burdens upon existing infrastructure particularly in developing countries. Most types of fertilizer plant require a large source of fresh water to operate efficiently and product must be removed quickly from the plant if costs of maintaining inventories are not to become excessive. Specialized technical staff for the operation of complex process facili-ies will normally need to be brought into the area in which the plant is to be built and, depending on the local availability of skilled and qualified manpower, a high proportion of the staff in the initial years of operation may well be expatriates. The need to accomodate and support a large expatriate staff must be taken into account and may result in undue extra costs and burdens on the social infrastructure in a developing country e.g. housing, schools, hospitals.

Amidst all the arguments on the relative economics of small and large plants it must not be forgotten that the ultimate aim of any plant is to satisfy the existing or projected demand for its product. Where a reasonably large local demand already exists for a product then the choice of plant size will usually be based upon satisfying this demand with its projected growth over some reasonable period of time. Substitution of fertilizer imports with local product is usually adequate justification for the plant but the necessity to consider the economics of production then exists in order to determine whether imported products may be cheaper and whether product initially surplus to existing demand can be profitably sold in other markets.

The term "economic size" is usually interpreted in the context of process plants to mean the size beyond which unit cost of production would cease to show any marked decrease. Various factors will affect this "break-point" for any particular project situation and the eventual choice of plant size must be a balanced decision taking into account firstly the market situation and secondly the results of evaluating capacity related economic factors.

The economies achieved by large plants in industrialized countries are rarely achievable in De-

veloping Countries. However, smaller plants in developing countries can, if properly conceived and operated, produce economies which will approach those of large plants in Industrialized Countries. Therefore when taking into acccunt savings in foreign exchange and the advantages of security and stability of supply, a plant can be justified at much lower capacity than would be so in the Developed World.

The question whether a mini or a big plant should be established in a developing country and where it should be installed is not only a function of the local market, the availability of raw materials, the specific investment and production costs, but quite a number of other factors must be taken into consideration, too.

Such points are, for example:

- The distance between the deposits of the raw material and the area of utilization;
- Conditions for the infrastructure, utility provisions, erection and operating personal availability etc.;
- Transport and storage facilities;
- Quality and quantity of the local raw materials available;

- Market conditions, transport facilities of the finished product etc.

The investment and operating costs of the plants to be established, on the other hand is a function of the following factors:

- capacity;
- technology;
- characteristics of the site;
- local laws, technical, economic and other prevailing rules and regulations.

In order to compare the economic value of the different possible solutions of the same supply problem the following method is applied.

Summary of the methodology adopted

Based on conceptual deliberations with the methodological description and the detailed calculations, the total investment costs for a plant in an industrially developed country were established from the battery limit investment costs. The investment cost for the same in a developing country were derived by application of factors. The factors used are given in the Appendix 3/1 referred to.

As the projects in every case have been examined for identical site conditions, it is necessary to indicate the local conditions defined by the denominations /developed site, seaside location, remote location/.

Developed site - West Europe

Means a site with developed infrastructure and high technical background, where a staff of well-trained experts and an established logistic system are available.

Developing site: seaside location

Means a site where the infrastructure has to be partly developed. This and the time necessary for its realization must be taken into account as a cost-increasing factor. Transport facilities are restricted but a sea or river harbour is available. Construction and operation are to be performed partly by less skilled labour.

Developing site: remote location

Means a continental /inner/ site where no infrastructure is existing and in lack of a highway/railway network, transport difficulties should be reckoned with.The realization period is prolonged, partly by the former factors, partly by unskilled and unexperienced labour. All these justify a further increase of costs.

When establishing the factors used for the investment cost estimation on the previously defined sites, factors like: customs prescription, risks, differing transport and financing conditions etc., are not considered, since these may only be estimated in knowledge of the actual conditions; their generalization does not seem reasonable.

Several studies deal with the estimation of factors necessary for establishing the investment cost requirements with plants to be realized in developing countries. The most detailed evaluation method among them is given by the study of the Gulf Organization for Industrial Consulting /1/, it compares, by a weighting-evaluating system for every factor, an investment being realized in three types of developing countries on different development levels, to the investment costs of a similar object in the USA.

The results, as compared to USA investment costs, are:

1./ For a "relatively developed" developing country factor: 1.35

2./ For a "less developed" developing country factor: 2.10

3./ For a quite underdeveloped country, factor: 3.05

These factors, however, consider not only the total investment cost but also the contracting and financial possibilities.

---

/1/ Anon: Construction, production and distribution cost of petrochemical projects. GOIC Seminar, Dona, Quatar, 20th Sept. 2nd Oct. 1979.

In the study of the UNIDO/OPEC found the following statement /1/.

| | | |
|---|---|---|
| Location factors: | U.S. Gulf Coast | = 1.0 |
| | Latin America | = 1.3 |
| | Mid-East and China | = 1.5 |
| | Africa and Asia | = 2.0 |

In an 1978 UNIDO paper /2/, it can bw found that the local factors are very difficult to estimate. It is mentioned that the TVA calculations generally consider a factor of 1.25 but many other authors think it to be low.

The factor used in this paper for an ammonia-urea plant is

| | |
|---|---|
| for a site with some infrastructure | 1.35 |
| for a remote location | 1.74 |

A factor of practically the same value is considered in a paper elaborated likewise by W.F. Sheldrick /3/ for a 1000 t/d ammonia and 1700 t/d urea plant are estimated

---

/1/ Anon: Opportunities for cooperation among developing countries for the establishment of petrochemical industries
UNIDO/OPEC Fund Seminar, Vienna, 7-9 March, 1983

/2/Anon: W.F. Sheldrick: Investment and production cost of fertilizers
UNIDO, 2nd Cons.Meeting on Fert.Ind., Innsbruck, Austria, 6-10 Nov. 1978

/3/ Anon: W.F. Scheldrick: Investment and production costs for fertilizers.
FAO Commission on Fertilizers 8th Session, Rome, 31.Jan. - 3.Febr., 1983

as follows:

| | |
|---|---|
| developed site | 1.0 /231 MDollar/ |
| developing site /some infrastructure/ | 1.4 /323 MDollar/ |
| developing site /remote location/ | 1.75 /405 MDollar/ |

In this study the following factors for the total general investment costs are applied:

| | | |
|---|---|---|
| small plants: | seaside location: | 1.27 - 1.29 |
| | remote location: | 1.43 - 1.50 |
| big plants: | seaside location: | 1.47 - 1.49 |
| | remote location: | 1.91 - 1.93 |

Investment costs

The first phase of the economical evaluation is the examination of the capital expenditure necessary for the fulfilment of a given requirement by domestic production. The amount of capital needed influences of course also the production costs. When establishing the total investment costs for the objects examined, the following procedure has been followed:

Developed site

A) Total investment cost:

To the cost requirement calculated within the battery limit, we added the off-sites costs to be expected; the amount of it makes, according to literature data and our own experiences, abt. 30 per cent of the full investment cost. Both the battery limit and off-sites costs were broken down into equipment and local costs. This breakdown is based, within the battery limits, on the detailed cost calculation but, generally, the proportion may be estimated to be 70: 30 per cent.

Within the off-site costs, the breakdown has been estimated - on the basis of experience - to be as follows:

equipment ..... 40 per cent

local cost..... 60 per cent

We already established total investment cost has been broken down into the following cost factors (based on calculation and proportions given by experience).

B/ Total investment cost

- licence, know-how /percentage within battery limits/
- engineering /percentage within battery limits + + 8 per cent off-sites cost/
- equipment /costs for battery limit plus offsite equipment, from which the extra given licence, know-how and engineering costs have been subtracted/
- site preparation etc. covers preparation, civil work and other costs

Developing site

the investment costs to be expected may be derived from the costs estimated on the basis of developed country /i,e. West-Europe/, considering different factors. The factor values characterize those condition differences increasing the costs which will - up to our opinion - influence the establishment of a small or big plant, resp. on different sites of developing countries and which cannot be calculated in a concise manner.

For the total investment costs calculated with the different estimated factors, the following average factors were found:

small plants - seaside location 1.27 - 1.29
remote location 1.43 - 1.50

big plants - seaside location 1.47 - 1.49

remote location 1.91 - 1.93

Detailed indications of the factors used in the calculations are given in the following table. /A 3/1.1/ The investment costs have been estimated on the price level for the year 1983.

Production costs

The production costs have been calculated for 1 ton of product, with consideration of the capacity given in t/d and the on-stream factor.

The on-stream factor is: for a West-Europe realization

with all plant sizes 90 per cent

for developing countries

with small plants 90 per cent

with big plants 75 per cent

The basis for material and energy costs is the specific requirement determined by the technology; labour costs have been calculated on basis of the necessary yearly staff. The costs proportional to the means (fixed costs) are a function of the investment costs. Prices and costs factors utilized have been summarized in an extra table.

Appendix 3/1 Table A 3/1.1

**Factors used in estimation for investment costs**

| | Developed site | Developing site | | | |
|---|---|---|---|---|---|
| | West-Europe | Seaside location | | Remote location | |
| | | miniplant | big plant | miniplant | big plant |
| battery limit | | | | | |
| - equipment cost | 1 x | +8% transport cost | | +10% transport cost | |
| - local cost | 1 x | x 1,3 | x 1,5 | x 1,5 | x 2,0 |
| off-site | | | | | |
| - equipment cost | 1 x | x 1,5 +8 transport cost | x 2,0 | x 2,0 +10% transport cost | x 3,0 |
| - local cost | 1 x | x 1,5 | x 2,0 | x 2,0 | x 3,0 |

Costs calculated for 1 ton of product have been increased by the sum of R.O.I. calculated likewise for 1 t (15 per cent). Costs on the basic materials have not been shown among the materials themselves but in consideration of the price ranges given for the sites, for the value increased by R.O.I.

According to the supposition, a plant should only be founded in a developing country if the basic materials occur in the country; thus, the unit prices of the basic materials have not simply been entered into the calculation on international market prices but also at an estimated value representing the costs of local extraction. Only sulphur has been considered to form an exception since it cannot be taken as usual that raw phsophate and sulphur occur simultaneously, on one site.

The value thus found represents the product value at the factory gate, to be still increased by distribution costs up to the end user. The magnitude of distribution costs is determined by the area to be furnished which again depends on the plant capacity.

The distribution costs have been estimated, with small plants, for a supply region of 100 km in diameter and with big plants, for a supply area of 300 km in diameter. Here, as a matter of fact, we had to rely on data from the literature. These costs may be estimated with a small plant at 15 $/t and with big plants, at 60 $/t.

Both the importance of the supply region and the distribution costs for 1 to of product depend on the local conditions and on the specific consumption of nutrients used for 1 ha of soil; therefore, considerable scattering of these costs may be imagined.

The costs on 1 t of product so far summarized are characteristic for the costs at the end users /farm-gate price/, without considering the application costs; we have not concentrated on these costs since they are identical whether the product comes from a small or from a big plant or even if it is an imported fertilizer.

The farm-gate price calculated from the complexes on 1 t of finished fertilizer product may be compared to the costs of 1 t of imported fertilizer of equal quality, also at farm-gate price.

The costs of the latter have been determined

starting from the costs of 1 t of product (nitrogen fertilizer) manufactured in a European big plant, out of natural gas (with a heat price of 5.9 and 11.8 $/Gcal), increased by sea transport charges (in average, 70 $/t), and in case of remote location, by the land freight charges (in average, say 25 $/t) plus the usual distribution costs for a region of identical dimension than that of the home production.

Further, we considered as characteristic the total investment costs on 1 t, with the fertilizer plants of different capacities and different basic materials (the specific investment cost) which have been found by dividing the total investment costs by the yearly production figures, while taking into calculation the on-stream factors.

Appendix 3/1 Table A.3/1.2

Unit prices, capital-related and labour-related cost

| | | Developed site | Developing site |
|---|---|---|---|
| | | West-Europe | Seaside and Remote location |
| **Materials:** | | | |
| Natural gas ($8500\ kcal/m^3$) | $/$10^3 m^3$ | 30, 50, 100, 150 | 15, 30, 50, 100 |
| | $/Gcal | 3.5, 5.9, 11.8, 17.6 | 1.8, 3.5, 5.9, 11.8 |
| Fuel oil (10 000 kcal/kg) | $/t | 150, 180 | 120 150 |
| | $/Gcal | 15, 18 | 12, 15 |
| Coal (2200 kcal/kg) | $/t | 15, 30, 50 | 10, 20, 30 |
| | $/Gcal | 6.8, 13.6, 22.7 | 4.6, 9.1, 13.6 |
| Phosphate rock ($32.5\%P_2O_5$) | $/t | 50, 70 | 15, 30, 50 |
| Sulphur | $/t | 90 | 100 |
| Potash | $/t | 70 | - |
| Lime | $/t | 25 | 25 |
| Coating agent | $/t | 60 | 60 |
| Anti-caking agent | $/t | 1000 | 1000 |
| MgO | S/t | 250 | 250 |
| Platina | $/kg | 13200 | 13200 |

Table A.3/1.2 /cont'd/

Utilities:[x]

| | | | |
|---|---|---|---|
| Power | $/MWh | 30 | 30 |
| Steam | $/t | 15 | 15 |
| BFW | $/10$^3$m$^3$ | 160 | 160 |
| BFW /demineralized/ | $/10$^3$m$^3$ | 500 | 500 |
| Cooling water | $/10$^3$m$^3$ | 20 | 20 |
| Process water | $/10$^3$m$^3$ | 12 | 12 |

| | | | |
|---|---|---|---|
| Labor | $/men/y | 15 000 | 8 000 |
| Overhead expenses % of total labour cost | | 150 | 250 |
| Depreciation % of total investment cost | | 10 | 10 |
| Maintenance % of total investment cost | | 3 | 4 |
| Insurance and property taxes % of total investment cost | | 2 | 3 |
| R.O.I. | % | 15 | 15 |

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[x]No diffefence has been made in the prices of utilities for developed and developing countries, the investment cost of utility objects having been increased by factors characteristical for the site, in the case of developing sites.

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Table 1-1,1

**Product:** Ammonia
**Raw material:** natural gas
**Location:** Developed site, West-Europe

| Capacity | t/d | 150 | 250 | 1000 |
|---|---|---|---|---|
| A./ Total investment cost | M$ | 29,0 | 39,0 | 145,0 |
| -battery limit | " | 20,0 | 27,0 | 100,0 |
| -equipment | " | 14,0 | 19,0 | 70,0 |
| -local cost | " | 6,0 | 8,0 | 30,0 |
| -off-sites | " | 9,0 | 12,0 | 45,0 |
| -equipment | " | 3,6 | 4,8 | 18,0 |
| -local cost | " | 5,4 | 7,2 | 27,0 |
| B./ Total investment cost | M$ | 29,0 | 39,0 | 145,0 |
| -licence,know-how | " | 0,4 | 0,6 | 2,0 |
| -engineering | " | 3,9 | 5,3 | 13,6 |
| -equipment | " | 13,3 | 17,9 | 66,4 |
| -site preparation, civil work,erection at site,other costs | " | 11,4 | 15,2 | 57,0 |

**Product:** Ammonia
**Raw material:** natural gas
**Location:** Developing site, Seaside

| Capacity | t/d | 150 | 200 | 1000 |
|---|---|---|---|---|
| A./ Total investment cost | M$ | 37,0 | 49,6 | 213,5 |
| -battery limit | " | 23,0 | 31,0 | 120,6 |
| -equipment | " | 15,2 | 20,5 | 75,6 |
| -local cost | " | 7,8 | 10,5 | 45,0 |
| -off-sites | " | 14,0 | 18,6 | 92,9 |
| -equipment | " | 5,8 | 7,8 | 38,9 |
| -local cost | " | 8,2 | 10,8 | 54,0 |
| B./ Total investment cost | M$ | 37,0 | 49,6 | 213,5 |
| -licence,know-how | " | 0,5 | 0,7 | 3,0 |
| -engineering | " | 4,8 | 6,5 | 26,7 |
| -equipment | " | 15,9 | 21,1 | 84,8 |
| -site preparation, civil work,erection at site,other costs | " | 15,9 | 21,3 | 99,0 |

Table 1-1.2

**Product:** Ammonia
**Raw material:** natural gas
**Location:** Developing site, Remote

| | Capacity | t/d | 150 | 250 | 1000 |
|---|---|---|---|---|---|
| A./ | Total investment cost | M$ | 43,0 | 58,0 | 277,4 |
| | -battery limit | " | 24,4 | 33,0 | 137,0 |
| | -equipment | " | 15,4 | 20,9 | 77 |
| | -local cost | " | 9,0 | 12,1 | 60 |
| | -off-sites | " | 18,6 | 25,0 | 140,4 |
| | -equipment | " | 7,9 | 10,6 | 59,4 |
| | -local cost | " | 10,7 | 14,4 | 81,0 |
| B./ | Total investment cost | M$ | 43,0 | 58,0 | 277,4 |
| | -licence,know-how | " | 0,6 | 0,9 | 4,0 |
| | -engineering | " | 5,4 | 7,3 | 33,2 |
| | -equipment | " | 17,3 | 23,3 | 99,2 |
| | -site preparation, civil work,erection at site,other costs | " | 19,7 | 26,5 | 141,0 |

**Product:** Ammonia
**Raw material:** fuel oil
**Location:** Developed site, West-Europe

| | Capacity | t/d | 150 | 250 | 1000 |
|---|---|---|---|---|---|
| A./ | Total investment cost | M$ | 33,0 | 45,0 | 167,0 |
| | -battery limit | " | 23,0 | 31,0 | 115,0 |
| | -equipment | " | 16,1 | 21,7 | 80,5 |
| | -local cost | " | 6,9 | 9,3 | 34,5 |
| | -off-sites | " | 10,0 | 14,0 | 52,0 |
| | -equipment | " | 4,0 | 5,6 | 20,8 |
| | -local cost | " | 6,0 | 8,4 | 31,2 |
| B./ | Total investment cost | M$ | 33,0 | 45,0 | 167,0 |
| | -licence,know-how | " | 0,5 | 0,6 | 2,3 |
| | -engineering | " | 4,5 | 6,1 | 22,6 |
| | -equipment | " | 15,1 | 20,6 | 76,4 |
| | -site preparation, civil work,erection at site,other costs | " | 12,9 | 17,7 | 65,7 |

**Product:** Ammonia
**Raw material:** fuel oil
**Location:** Developing site, Seaside

| Capacity | t/d | 150 | 250 | 1000 |
|---|---|---|---|---|
| A./ Total investment cost | M$ | 42,0 | 57,0 | 246,0 |
| -battery limit | " | 26,5 | 35,5 | 138,8 |
| -equipment | " | 17,5 | 23,4 | 87,0 |
| -local cost | " | 9,0 | 12,1 | 51,8 |
| -off-sites | " | 15,5 | 21,5 | 107,2 |
| -equipment | " | 6,5 | 9,0 | 45,0 |
| -local cost | " | 9,0 | 12,5 | 62,2 |
| B./ Total investment cost | M$ | 42,0 | 57,0 | 246,0 |
| -licence,know-how | " | 0,6 | 0,8 | 3,5 |
| -engineering | " | 5,4 | 7,4 | 30,8 |
| -equipment | " | 18,0 | 24,2 | 97,7 |
| -site preparation, civil work,erection at site,other costs | " | 18,0 | 24,6 | 114,0 |

**Product:** Ammonia
**Raw material:** fuel oil
**Location:** Developing site, Remote

Table 1-1.6

| | Capacity | t/d | 150 | 250 | 1000 |
|---|---|---|---|---|---|
| A./ | Total investment cost | M$ | 49,0 | 67,0 | 320,0 |
| | -battery limit | " | 28,0 | 38,0 | 157,8 |
| | -equipment | " | 17,7 | 24,0 | 88,6 |
| | -local cost | " | 10,3 | 14,0 | 69,2 |
| | -off-sites | " | 21,0 | 29,0 | 162,2 |
| | -equipment | " | 9,0 | 12,3 | 68,6 |
| | -local cost | " | 12,0 | 16,7 | 93,6 |
| B./ | Total investment cost | M$ | 49,0 | 67,0 | 320,0 |
| | -licence,know-how | " | 0,8 | 0,9 | 4,6 |
| | -engineering | " | 6,2 | 8,4 | 38,2 |
| | -equipment | " | 19,7 | 27,0 | 114,4 |
| | -site preparation, civil work,erection at site,other costs | " | 22,3 | 30,7 | 162,8 |

Table 1-1.7

Product: Ammonia
Raw material: coal
Location: Developed site, West-Europe

| | Capacity | t/d | 150 | 250 | 1000 |
|---|---|---|---|---|---|
| A./ | Total investment cost | M$ | 46,0 | 62,0 | 232,0 |
| | -battery limit | " | 32,0 | 43,0 | 160,0 |
| | -equipment | " | 22,4 | 30,0 | 112,0 |
| | -local cost | " | 9,6 | 13,0 | 48,0 |
| | -off-sites | " | 14,0 | 19,0 | 72,0 |
| | -equipment | " | 5,6 | 7,6 | 28,8 |
| | -local cost | " | 8,4 | 11,4 | 43,2 |
| B./ | Total investment cost | M$ | 46,0 | 62,0 | 232,0 |
| | -licence,know-how | " | 0,6 | 0,9 | 3,2 |
| | -engineering | " | 6,2 | 8,4 | 31,4 |
| | -equipment | " | 21,2 | 28,3 | 106,2 |
| | -site preparation, civil work,erection at site,other costs | " | 18,0 | 24,4 | 91,2 |

**Product:** Ammonia
**Raw material:** coal
**Location:** Developed site, Seaside

| Capacity | t/d | 150 | 250 | 1000 |
|---|---|---|---|---|
| A./ Total investment cost | MØ | 58,0 | 78,8 | 341,5 |
| -battery limit | " | 36,5 | 49,4 | 193,0 |
| -equipment | " | 24,1 | 32,4 | 121,0 |
| -local cost | " | 12,4 | 17,0 | 72,0 |
| -off-sites | " | 21,5 | 29,4 | 148,5 |
| -equipment | " | 9,0 | 12,3 | 62,1 |
| -local cost | " | 12,5 | 17,1 | 86,4 |
| B./ Total investment cost | MØ | 58,0 | 78,8 | 341,5 |
| -licence,know-how | " | 0,8 | 1,2 | 4,8 |
| -engineering | " | 7,5 | 10,3 | 42,8 |
| -equipment | " | 24,8 | 33,2 | 135,5 |
| -site preparation, civil work,erection at site,other costs | " | 24,9 | 34,1 | 158,4 |

Product: Ammonia
Raw material: coal
Location: Developing site, Remote

| | Capacity | t/d | 150 | 250 | 1000 |
|---|---|---|---|---|---|
| A./ | Total investment cost | M$ | 63,0 | 92,0 | 444,0 |
| | -battery limit | " | 39,0 | 52,5 | 219,4 |
| | -equipment | " | 24,6 | 33,0 | 123,4 |
| | -local cost | " | 14,4 | 19,5 | 96,0 |
| | -off-sites | " | 29,0 | 39,5 | 224,6 |
| | -equipment | " | 12,2 | 16,7 | 95,0 |
| | -local cost | " | 16,8 | 22,8 | 129,6 |
| B./ | Total investment cost | M$ | 63,0 | 92,0 | 444,0 |
| | -licence,know-how | " | 0,9 | 1,4 | 6,4 |
| | -engineering | " | 8,5 | 11,6 | 53,1 |
| | -equipment | " | 27,4 | 36,7 | 158,9 |
| | -site preparation, civil work,erection at site,other costs | " | 31,2 | 42,3 | 225,6 |

Table 1-1.9

**Product:** Nitric acid
**Raw material:**
**Location:** Developed site, West-Europe

| | Capacity | t/d | 273 | 455 | 1822 |
|---|---|---|---|---|---|
| A./ | Total investment cost | M$ | 14,2 | 23,6 | 94,7 |
| | -battery limit | " | 9,8 | 16,3 | 65,3 |
| | -equipment | " | 6,7 | 11,4 | 45,7 |
| | -local cost | " | 3,1 | 4,9 | 19,6 |
| | -off-sites | " | 4,4 | 7,3 | 29,4 |
| | -equipment | " | 1,8 | 2,9 | 11,8 |
| | -local cost | " | 2,6 | 4,4 | 17,6 |
| B./ | Total investment cost | M$ | 14,2 | 23,6 | 94,7 |
| | -licence,know-how | " | 0,3 | 0,5 | 2,0 |
| | -engineering | " | 1,1 | 1,9 | 7,6 |
| | -equipment | " | 7,1 | 11,9 | 47,9 |
| | -site preparation, civil work,erection at site,other costs | " | 5,7 | 9,3 | 37,2 |

**Product:** Nitric acid
**Raw material:**
**Location:** Developing site, Seaside

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 273 | 455 | 1822 |
| A./ Total investment cost | M$ | 18,0 | 30,0 | 139,5 |
| -battery limit | " | 11,2 | 18,7 | 78,8 |
| -equipment | " | 7,2 | 12,3 | 49,4 |
| -local cost | " | 4,0 | 6,4 | 29,4 |
| -off-sites | " | 6,8 | 11,3 | 60,7 |
| -equipment | " | 2,9 | 4,7 | 25,5 |
| -local cost | " | 3,9 | 6,6 | 35,2 |
| B./ Total investment cost | M$ | 18,0 | 30,0 | 139,5 |
| -licence,know-how | " | 0,4 | 0,6 | 3,0 |
| -engineering | " | 1,4 | 2,4 | 11,2 |
| -equipment | " | 8,3 | 14,0 | 60,7 |
| -site preparation, civil work,erection at site,other costs | " | 7,9 | 13,0 | 64,6 |

**Product:** Nitric acid
**Raw material:**
**Location:** Developing site, Remote

| | Capacity | t/d | 273 | 455 | 1822 |
|---|---|---|---|---|---|
| A./ | Total investment cost | M$ | 21,3 | 35,1 | 181,2 |
| | -battery limit | " | 12,1 | 19,9 | 89,5 |
| | -equipment | " | 7,4 | 12,5 | 50,3 |
| | -local cost | " | 4,7 | 7,4 | 39,2 |
| | -off-sites | " | 9,2 | 15,2 | 91,7 |
| | -equipment | " | 4,0 | 6,4 | 38,9 |
| | -local cost | " | 5,2 | 8,8 | 52,8 |
| B./ | Total investment cost | M$ | 21,3 | 35,1 | 181,2 |
| | -licence,know-how | " | 0,5 | 0,8 | 4,0 |
| | -engineering | " | 1,7 | 2,8 | 14,5 |
| | -equipment | " | 9,2 | 15,3 | 70,7 |
| | -site preparation, civil work,erection at site,other costs | " | 9,9 | 16,2 | 92,0 |

Product: Ammonium nitrate
Raw material:
Location: Developed site, West-Europa

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 355 | 591 | 2364 |
| A./ Total investment cost | M$ | 10,9 | 16,2 | 48,7 |
| -battery limit | " | 7,5 | 11,2 | 33,6 |
| -equipment | " | 5,3 | 7,8 | 23,5 |
| -local cost | " | 2,2 | 3,4 | 10,1 |
| -off-sites | " | 3,4 | 5,0 | 15,1 |
| -equipment | " | 1,4 | 2,0 | 6,0 |
| -local cost | " | 2,0 | 3,0 | 9,1 |
| B./ Total investment cost | M$ | 10,9 | 16,2 | 48,7 |
| -licence,know-how | " | 0,2 | 0,3 | 1,0 |
| -engineering | " | 1,4 | 2,0 | 5,9 |
| -equipment | " | 5,1 | 7,5 | 22,6 |
| -site preparation, civil work,erection at site,other costs | " | 4,2 | 6,4 | 19,2 |

**Product:** Ammonium nitrate

**Raw material:**

**Location:** Developing site, Seaside

| | | | | |
|---|---|---|---|---|
| **Capacity** | t/d | 355 | 591 | 2364 |
| A./ **Total investment cost** | M$ | 13,9 | 20,5 | 71,8 |
| -battery limit | " | 8,6 | 12,8 | 40,8 |
| -equipment | " | 5,7 | 8,4 | 25,4 |
| -local cost | " | 2,9 | 4,4 | 15,2 |
| -off-sites | " | 5,3 | 7,7 | 31,2 |
| -equipment | " | 2,3 | 3,2 | 13,0 |
| -local cost | " | 3,0 | 4,5 | 18,2 |
| B./ **Total investment cost** | M$ | 13,9 | 20,5 | 71,8 |
| -licence, know-how | " | 0,3 | 0,4 | 1,5 |
| -engineering | " | 1,6 | 1,9 | 8,2 |
| -equipment | " | 6,1 | 9,3 | 28,7 |
| -site preparation, civil work, erection at site, other costs | " | 5,9 | 8,9 | 33,4 |

Table 1-1.15

**Product:** Ammonium nitrate
**Raw material:**
**Location:** Developing site, Remote

| | Capacity | t/d | 355 | 591 | 2364 |
|---|---|---|---|---|---|
| A./ | Total investment cost | M$ | 16,2 | 24,1 | 93,2 |
| | -battery limit | " | 9,1 | 13,7 | 46,1 |
| | -equipment | " | 5,8 | 8,6 | 25,9 |
| | -local cost | " | 3,3 | 5,1 | 20,2 |
| | -off-sites | " | 7,1 | 10,4 | 47,1 |
| | -equipment | " | 3,1 | 4,4 | 19,8 |
| | -local cost | " | 4,0 | 6,0 | 27,3 |
| B./ | Total investment cost | M$ | 16,2 | 24,1 | 93,2 |
| | -licence,know-how | " | 0,3 | 0,5 | 2,0 |
| | -engineering | " | 1,9 | 2,7 | 10,3 |
| | -equipment | " | 6,7 | 9,8 | 33,4 |
| | -site preparation, civil work,erection at site,other costs | " | 7,3 | 11,1 | 47,5 |

**Product:** Urea
**Raw material:**
**Location:** Developed site, West-Europe

| | Capacity | t/d | 260 | 440 | 1700 |
|---|---|---|---|---|---|
| A./ | Total investment cost | M$ | 15,7 | 23,8 | 69,6 |
| | -battery limit | " | 10,8 | 16,4 | 48,0 |
| | -equipment | " | 7,6 | 11,5 | 33,6 |
| | -local cost | " | 3,2 | 4,9 | 14,4 |
| | -off-sites | " | 4,9 | 7,4 | 21,6 |
| | -equipment | " | 2,0 | 3,0 | 8,6 |
| | -local cost | " | 2,9 | 4,4 | 13,0 |
| B./ | Total investment cost | M$ | 15,7 | 23,8 | 69,6 |
| | -licence,know-how | " | 0,3 | 0,5 | 1,4 |
| | -engineering | " | 1,7 | 2,6 | 7,5 |
| | -equipment | " | 7,6 | 11,4 | 33,3 |
| | -site preparation, civil work,erection at site,other costs | " | 6,1 | 9,3 | 27,4 |

Table 1-1.16

**Product:** Urea
**Raw material:**
**Location:** Developing site, Seaside

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 260 | 440 | 1700 |
| A./ Total investment cost | M$ | 20,0 | 30,3 | 102,5 |
| -battery limit | " | 12,4 | 18,8 | 57,9 |
| -equipment | " | 8,2 | 12,4 | 36,3 |
| -local cost | " | 4,2 | 6,4 | 21,6 |
| -off-sites | " | 7,6 | 11,5 | 44,6 |
| -equipment | " | 3,2 | 4,9 | 18,6 |
| -local cost | " | 4,4 | 6,6 | 26,0 |
| B./ Total investment cost | M$ | 20,0 | 30,3 | 102,5 |
| -licence,know-how | " | 0,4 | 0,7 | 2,1 |
| -engineering | " | 2,1 | 3,2 | 10,5 |
| -equipment | " | 3,9 | 13,4 | 41,3 |
| -site preparation, civil work,erection at site,other costs | " | 8,6 | 13,0 | 48,6 |

**Product:** Urea
**Raw material:**
**Location:** Developing site, Remote

| | Capacity | t/d | 260 | 440 | 1700 |
|---|---|---|---|---|---|
| A./ | Total investment cost | M$ | 23,4 | 35,5 | 133,2 |
| | -battery limit | " | 13,2 | 20,1 | 65,8 |
| | -equipment | " | 8,4 | 12,7 | 37,0 |
| | -local cost | " | 4,8 | 7,4 | 28,8 |
| | -off-sites | " | 10,2 | 15,4 | 67,4 |
| | -equipment | " | 4,4 | 6,6 | 28,4 |
| | -local cost | " | 5,8 | 8,8 | 39,0 |
| B./ | Total investment cost | M$ | 23,4 | 35,5 | 133,2 |
| | -licence,know-how | " | 0,5 | 0,8 | 2,8 |
| | -engineering | " | 2,4 | 3,6 | 13,3 |
| | -equipment | " | 9,9 | 14,9 | 49,3 |
| | -site preparation, civil work,erection at site,other costs | " | 10,6 | 16,2 | 67,8 |

Table 1-1.18

Table 1-2.1

Product: Sulphuric acid
Raw material: sulphur
Location:

| | | Developed site West-Europe | Developing site Seaside | Developing site Remote |
|---|---|---|---|---|
| Capacity | t/d | 200 | 200 | 200 |
| A./Total investment cost | MØ | 9,7 | 12,3 | 14,4 |
| -battery limit | " | 6,7 | 7,7 | 8,2 |
| -equipment | " | 4,7 | 5,1 | 5,2 |
| -local cost | " | 2,0 | 2,6 | 3,0 |
| -off-sites | " | 3,0 | 4,6 | 6,2 |
| -equipment | " | 1,2 | 1,9 | 2,6 |
| -local cost | " | 1,8 | 2,7 | 3,6 |
| B./ Total investment cost | MØ | 9,7 | 12,3 | 14,4 |
| -licence,know-how | " | 0,2 | 0,3 | 0,3 |
| -engineering | " | 1,4 | 1,8 | 2,0 |
| -equipment | " | 4,3 | 4,9 | 5,5 |
| -site preparation, civil work,erection at site,other costs | " | 3,8 | 5,3 | 6,6 |

Product: Sulphuric acid
Raw material: sulphur
Location:

| | | Developed site West-Europe | Developing site Seaside | Developing site Remote |
|---|---|---|---|---|
| Capacity | t/d | 600 | 600 | 600 |
| A./Total investment cost | M$ | 22,5 | 28,6 | 33,5 |
| -battery limit | " | 15,5 | 17,8 | 18,9 |
| -equipment | " | 11,0 | 11,9 | 12,1 |
| -local cost | " | 4,5 | 5,9 | 6,8 |
| -off-sites | " | 7,0 | 10,8 | 14,6 |
| -equipment | " | 2,8 | 4,5 | 6,2 |
| -local cost | " | 4,2 | 6,3 | 8,4 |
| B./ Total investment cost | M$ | 22,5 | 28,6 | 33,5 |
| -licence,know-how | " | 0,5 | 0,7 | 0,8 |
| -engineering | " | 3,4 | 4,1 | 4,6 |
| -equipment | " | 9,9 | 11,4 | 12,9 |
| -site preparation, civil work,erection at site,other costs | " | 8,7 | 12,4 | 15,2 |

Table 1-2.2

Product: Phosphoric acid /100 % $P_2O_5$/

Raw material: phosphate rock

Location:

| | | Developed site | Developing site | |
|---|---|---|---|---|
| | | West-Europe | Seaside | Remote |
| Capacity | t/d | 200 | 200 | 200 |
| A./Total investment cost | M$ | 23,8 | 30,3 | 35,5 |
| -battery limit | " | 16,4 | 18,8 | 20,1 |
| -equipment | " | 11,5 | 12,4 | 12,7 |
| -local cost | " | 4,9 | 6,4 | 7,4 |
| -off-sites | " | 7,4 | 11,5 | 15,4 |
| -equipment | " | 3,0 | 4,9 | 6,6 |
| -local cost | " | 4,4 | 6,6 | 8,8 |
| B./ Total investment cost | M$ | 23,8 | 30,3 | 35,5 |
| -licence,know-how | " | 0,5 | 0,6 | 0,8 |
| -engineering | " | 4,2 | 5,0 | 5,6 |
| -equipment | " | 9,8 | 11,7 | 12,7 |
| -site preparation, civil work,erection at site,other costs | " | 9,3 | 13,0 | 16,4 |

Table 1-2.3

Product: SSP /18% $P_2O_5$/

Raw material: phosphate rock

Location:

| | | Developed site West-Europe | Developing site Seaside | Developing site Remote |
|---|---|---|---|---|
| Capacity | t/d | 500 | 500 | 500 |
| A./Total investment cost | M$ | 4,4 | 5,7 | 6,6 |
| -battery limit | " | 3,0 | 3,5 | 3,7 |
| -equipment | " | 2,1 | 2,3 | 2,3 |
| -local cost | " | 0,9 | 1,2 | 1,4 |
| -off-sites | " | 1,4 | 2,2 | 2,9 |
| -equipment | " | 0,6 | 1,0 | 1,3 |
| -local cost | " | 0,8 | 1,2 | 1,6 |
| B./ Total investment cost | M$ | 4,4 | 5,7 | 6,6 |
| -licence,know-how | " | 0,1 | 0,1 | 0,2 |
| -engineering | " | 0,6 | 0,7 | 0,8 |
| -equipment | " | 2,0 | 2,5 | 2,6 |
| -site preparation, civil work,erection at site,other costs | " | 1,7 | 2,4 | 3,0 |

Product: TSP /46% $P_2O_5$/
Raw material:
Location:

| | | Developed site West-Europe | Developing site Seaside | Developing site Remote |
|---|---|---|---|---|
| Capacity | t/d | 500 | 500 | 500 |
| A./Total investment cost | M$ | 5,1 | 6,5 | 7,6 |
| -battery limit | " | 3,5 | 4,0 | 4,3 |
| -equipment | " | 2,5 | 2,7 | 2,8 |
| -local cost | " | 1,0 | 1,3 | 1,5 |
| -off-sites | " | 1,6 | 2,5 | 3,3 |
| -equipment | " | 0,6 | 1,0 | 1,3 |
| -local cost | " | 1,0 | 1,5 | 2,0 |
| B./ Total investment cost | M$ | 5,1 | 6,5 | 7,6 |
| -licence,know-how | " | 0,1 | 0,1 | 0,2 |
| -engineering | " | 0,7 | 0,9 | 1,0 |
| -equipment | " | 2,3 | 2,7 | 2,9 |
| -site preparation, civil work,erection at site,other costs | " | 2,0 | 2,8 | 3,5 |

**Product:** MAP /12% N + 52% $P_2O_5$/, or DAP /18% N + 46% $P_2O_5$/ NPK /19:19:19/

**Raw material:**

**Location:** Developed site, West-Europe

| | | | | |
|---|---|---|---|---|
| | **Capacity** | t/d | 375 | 1040 |
| A./ | Total investment cost | M$ | 8,1 | 12,5 |
| | -battery limit | " | 5,6 | 8,6 |
| | -equipment | " | 3,9 | 6,0 |
| | -local cost | " | 1,7 | 2,6 |
| | -off-sites | " | 2,5 | 3,9 |
| | -equipment | " | 1,0 | 1,6 |
| | -local cost | " | 1,5 | 2,3 |
| B./ | Total investment cost | M$ | 8,1 | 12,5 |
| | -licence,know-how | " | 0,2 | 0,3 |
| | -engineering | " | 1,3 | 1,8 |
| | -equipment | " | 3,4 | 5,5 |
| | -site preparation, civil work,erection at site,other costs | " | 3,2 | 4,9 |

Appendix 3/1

Table 2-1

## Specific investment cost $/t/y product

| | | Developed site | Developing site | |
|---|---|---|---|---|
| | | West-Europe | Seaside location | Remote location |
| **Ammonia** | | | | |
| | **Feedstock** | | | |
| 150 t/d | nat.gas | 580 | 740 | 860 |
| | fuel oil | 660 | 840 | 980 |
| | coal | 920 | 1160 | 1360 |
| 250 t/d | nat.gas | 470 | 598 | 700 |
| | fuel oil | 542 | 687 | 807 |
| | coal | 747 | 950 | 1108 |
| 1000t/d | nat.gas | 440 | 776 | 1010 |
| | fuel oil | 506 | 895 | 1164 |
| | coal | 703 | 1242 | 1615 |
| **Nitric acid** | | | | |
| 273 t/d | | 158 | 200 | 237 |
| 455 t/d | | 157 | 200 | 234 |
| 1822 t/d | | 158 | 279 | 362 |
| **Ammonium nitrate** | | | | |
| 355 t/d | | 93 | 119 | 138 |
| 591 t/d | | 83 | 105 | 124 |
| 2364 t/d | | 62 | 110 | 143 |
| **Urea** | | | | |
| 260 t/d | | 183 | 232 | 272 |
| 440 t/d | | 164 | 209 | 245 |
| 1700 t/d | | 124 | 219 | 285 |

Appendix 3/1

Table 2-2

## Specific investment cost $/t/y product

| | Developed site West-Europe | Developing site Seaside | Developing site Remote location |
|---|---|---|---|
| **Sulphuric acid** | | | |
| 200 t/d | 147 | 186 | 218 |
| 600 t/d | 113 | 143 | 168 |
| **Phosphoric acid** | | | |
| 200 t/d $P_2O_5$ /370 t/d tel-quel/ | 360 | 459 | 538 |
| SSP 500 t/d | 27 | 36 | 41 |
| TSP 500 t/d | 32 | 40 | 47 |
| MAP 375 t/d | 68 | - | - |
| DAP 425 t/d | 62 | - | - |
| NPK 1040 t/d | 39 | - | - |

Table 3-1.1

## Total investment costs of ammonia- urea complexes

| | | | Developed site West- Europe | Developing site Seaside location | Developing site Remote location |
|---|---|---|---|---|---|
| **Urea 260 t/d** | | | | | |
| Feedstock: natural gas | $NH_3$ | M$ | 29,o | 37,o | 43,o |
| | Urea | M$ | 15,7 | 2o,o | 23,4 |
| | Total | M$ | 44,7 | 57,o | 66,4 |
| fuel oil | $NH_3$ | M$ | 33,o | 42,o | 49,o |
| | Urea | M$ | 15,7 | 2o,o | 23,4 |
| | Total | M$ | 48,7 | 62,o | 72,4 |
| coal | $NH_3$ | M$ | 46,o | 58,o | 68,o |
| | Urea | M$ | 15,7 | 2o,o | 23,4 |
| | Total | M$ | 61,7 | 78,o | 91,4 |
| **Urea 440 t/d** | | | | | |
| Feedstock: natural gas | $NH_3$ | M$ | 39,o | 49,6 | 58,o |
| | Urea | M$ | 23,8 | 3o,3 | 35,5 |
| | Total | M$ | 62,8 | 79,9 | 93,5 |
| fuel oil | $NH_3$ | M$ | 45,o | 57,o | 67,o |
| | Urea | M$ | 23,8 | 3o,3 | 35,5 |
| | Total | M$ | 68,8 | 87,3 | 1o2,5 |
| coal | $NH_3$ | M$ | 62,o | 78,8 | 92,o |
| | Urea | M$ | 23,8 | 3o,3 | 35,5 |
| | Total | M$ | 85,8 | 1o9,1 | 127,5 |
| **Urea 1700 t/d** | | | | | |
| Feedsock: natural gas | $NH_3$ | M$ | 145,o | 213,5 | 277,4 |
| | Urea | M$ | 69,6 | 1o2,5 | 133,2 |
| | Total | M$ | 214,6 | 316,o | 41o,6 |
| fuel oil | $NH_3$ | M$ | 167,o | 246,o | 32o,o |
| | Urea | M$ | 69,6 | 1o2,5 | 133,2 |
| | Total | M$ | 236,6 | 348,5 | 453,2 |
| coal | $NH_3$ | M$ | 232,o | 341,5 | 444,o |
| | Urea | M$ | 69,6 | 1o2,5 | 133,2 |
| | Total | M$ | 3o1,6 | 444,o | 577,2 |

Appendix 3/1

Table 3-1.2

Total investment cost of ammonia-nitric acid-ammonium nitrate complexes

| | | | | Developed site West- Europe | Developing site Seaside location | Developing site Remote location |
|---|---|---|---|---|---|---|
| **Ammonium nitrate 355 t/d** | | | | | | |
| Feedstock: | natural gas | $NH_3$ | MŠ | 29,0 | 37,0 | 43,0 |
| | | $HNO_3$ | MŠ | 14,2 | 18,0 | 21,3 |
| | | AN | MŠ | 10,9 | 13,9 | 16,2 |
| | | Total | MŠ | 54,1 | 68,9 | 80,5 |
| | fuel oil | $NH_3$ | MŠ | 33,0 | 42,0 | 49,0 |
| | | $HNO_3$ | MŠ | 14,2 | 18,0 | 21,3 |
| | | AN | MŠ | 10,9 | 13,9 | 16,2 |
| | | Total | MŠ | 58,1 | 73,9 | 86,5 |
| | coal | $NH_3$ | MŠ | 46,0 | 58,0 | 68,0 |
| | | $HNO_3$ | MŠ | 14,2 | 18,0 | 21,3 |
| | | AN | MŠ | 10,9 | 13,9 | 16,2 |
| | | Total | MŠ | 71,1 | 89,9 | 105,5 |
| **Ammonium nitrate 591 t/d** | | | | | | |
| Feedstock: | natural gas | $NH_3$ | MŠ | 39,0 | 49,6 | 58,0 |
| | | $HNO_3$ | MŠ | 23,6 | 30,0 | 35,1 |
| | | AN | MŠ | 16,2 | 20,5 | 24,1 |
| | | Total | MŠ | 78,8 | 100,1 | 117,2 |
| | fuel oil | $NH_3$ | MŠ | 45,0 | 57,0 | 67,0 |
| | | $HNO_3$ | MŠ | 23,6 | 30,0 | 35,1 |
| | | AN | MŠ | 16,2 | 20,5 | 24,1 |
| | | Total | MŠ | 84,8 | 107,5 | 126,2 |
| | coal | $NH_3$ | MŠ | 62,0 | 78,8 | 92,0 |
| | | $HNO_3$ | MŠ | 23,6 | 30,0 | 35,1 |
| | | AN | MŠ | 16,2 | 20,5 | 24,1 |
| | | Total | MŠ | 101,8 | 129,3 | 151,2 |
| **Ammonium nitrate 2364 t/d** | | | | | | |
| Feedstock: | natural gas | $NH_3$ | MŠ | 145,0 | 213,5 | 277,4 |
| | | $HNO_3$ | MŠ | 94,7 | 139,5 | 181,2 |
| | | AN | MŠ | 48,7 | 71,8 | 93,2 |
| | | Total | MŠ | 288,4 | 424,3 | 551,8 |
| | fuel oil | $NH_3$ | MŠ | 167,0 | 246,0 | 320,0 |
| | | $HNO_3$ | MŠ | 94,7 | 139,5 | 181,2 |
| | | AN | MŠ | 48,7 | 71,8 | 93,2 |
| | | Total | MŠ | 310,4 | 457,3 | 594,4 |
| | coal | $NH_3$ | MŠ | 232,0 | 341,5 | 444,0 |
| | | $HNO_3$ | MŠ | 94,7 | 139,5 | 181,2 |
| | | AN | MŠ | 48,7 | 71,8 | 93,2 |
| | | Total | MŠ | 375,4 | 552,8 | 718,4 |

Appendix 3/1

Table 3-2

## Total investment costs of phosphate complexes

| | | | Developed site | Developing site | |
|---|---|---|---|---|---|
| | | | West-Europe | Seaside location | Remote |
| SSP 500 t/d | | | | | |
| | $H_2SO_4$ | M$ | 9,7 | 12,3 | 14,4 |
| | SSP | M$ | 4,4 | 5,7 | 6,6 |
| | Total | M$ | 14,1 | 18,o | 21,o |
| TSP 500 t/d | | | | | |
| | $H_2SO_4$ | M$ | 22,5 | 28,6 | 33,5 |
| | $H_3PO_4$ | M$ | 23,8 | 3o,3 | 35,5 |
| | TSP | M$ | 5,1 | 6,5 | 7,6 |
| | Total | M$ | 51,4 | 65,4 | 76,6 |
| MAP 375 t/d | | | | | |
| | $H_2SO_4$ | M$ | 22,5 | 28,6 | 33,5 |
| DAP 425 t/d | $H_3PO_4$ | M$ | 23,8 | 3o,3 | 35,5 |
| | MAP /DAP/ | M$ | 8,1 | 1o,3 | 12,1 |
| | Total | M$ | 54,4 | 69,2 | 81,1 |
| NPK 1040 t/d | | | | | |
| | $H_2SO_4$ | M$ | 22,5 | 28,6 | 33,5 |
| | $H_3PO_4$ | M$ | 23,8 | 3o,3 | 35,5 |
| | NPK | M$ | 12,5 | 16,o | 18,6 |
| | Total | M$ | 58,8 | 74,9 | 87,6 |

## Specific investment costs of ammonia -nitric-acid- ammonium nitrate, ammonia-urea complexes

SpI$/t/y Ammonium-nitrate

| | Developed site West-Europe | Developing site Seaside location | Developing site Remote location |
|---|---|---|---|
| **Ammonium nitrate** | | | |
| 355 t/d | | | |
| Feedstock: nat.gas | 462 | 588 | 688 |
| fuel oil | 496 | 632 | 739 |
| coal | 608 | 768 | 902 |
| 591 t/d | | | |
| Feedstock: nat.gas | 404 | 513 | 601 |
| fuel oil | 435 | 551 | 647 |
| coal | 522 | 663 | 775 |
| 2364 t/d | | | |
| Feedstock: nat.gas | 370 | 654 | 849 |
| fuel oil | 398 | 704 | 914 |
| coal | 481 | 850 | 1105 |

SpI$/t/y urea

| | | | |
|---|---|---|---|
| **Urea** | | | |
| 260 t/d | | | |
| Feedstock: nat.gas | 520 | 663 | 772 |
| fuel oil | 566 | 721 | 842 |
| coal | 717 | 907 | 1063 |
| 440 t/d | | | |
| Feedstock: nat.gas | 433 | 551 | 644 |
| fuel oil | 475 | 602 | 707 |
| coal | 592 | 752 | 879 |
| 1700 t/d | | | |
| Feedstock: nat.gas | 383 | 675 | 877 |
| fuel oil | 422 | 745 | 968 |
| coal | 538 | 950 | 1233 |

Appendix 3/1

Table 4-1.2

Specific investment costs of 1 t N in ammonia - nitric acid - ammonium nitrate, ammonia-urea complexes

Sp.I.$/t N/y

Raw material: natural gas

| | Developing site | |
|---|---|---|
| | Seaside location | Remote |
| **Ammonium nitrate** | | |
| 355 t/d | 1729 | 2024 |
| 591 t/d | 1509 | 1768 |
| 2364 t/d | 1924 | 2497 |
| **Urea** | | |
| 260 t/d | 1441 | 1678 |
| 440 t/d | 1198 | 1400 |
| 1700 t/d | 1467 | 1907 |

Appendix 3/1

Table 4-2

Specific investment costs of phosphate complexes

Sp.I. $/t/y

| | Developed site | Developing site | |
|---|---|---|---|
| | West-Europe | Seaside location | Remote location |
| SSP | | | |
| 500 t/d | 85 | 109 | 127 |
| TSP | | | |
| 500 t/d | 312 | 396 | 464 |
| MAD | | | |
| 375 t/d | 440 | 558 | 654 |
| DAP | | | |
| 425 t/d | 390 | 494 | 579 |
| NPK | | | |
| 1040 t/d | 171 | 262 | 306 |

Product: Ammonia
Raw material: natural gas
Location: Developed site, West-Europe

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 150 | 250 | 1000 |
| On-stream factor | % | 90 | 90 | 90 |
| Production | kt/y | 50 | 83 | 330 |
| Total investment cost | M$ | 29,0 | 39,0 | 145 |
| Production cost | | | | |
| Materials | $/t | 8,0 | 8,0 | 8,0 |
| Chemicals | | | | |
| a./ Total materials | $/t | 8,0 | 8,0 | 8,0 |
| Utilities | $/t | | | |
| Power | " | 26,5 | - | 2,2 |
| Steam | " | - | - | - |
| BFW/demineralized/ | " | 0,9 | 0,6 | 0,6 |
| Cooling water | " | 10,3 | 5,4 | 2,4 |
| b./ Total utilities | $/t | 37,7 | 6,0 | 5,2 |
| c./ Labour | $/t | 9,6 | 5,8 | 1,5 |
| d./ Overhead expenses | $/t | 14,4 | 8,7 | 2,3 |
| e./ Total/a+b+c+d/ | $/t | 69,7 | 29,1 | 17,0 |
| f./ Depreciation | $/t | 58,0 | 47,0 | 43,9 |
| g./ Maintenance | $/t | 17,4 | 14,1 | 13,2 |
| h./ Insurance and property taxes | $/t | 11,6 | 9,4 | 8,8 |
| i./ Total /f+g+h/ | $/t | 87,0 | 70,5 | 65,9 |
| j./ Total production cost / e+i/ | $/t | 156,7 | 99,6 | 82,9 |
| k./ 15% R.O.I. | $/t | 87,0 | 70,5 | 65,9 |
| l./ Total /j+k/ | $/t | 243,7 | 170,1 | 148,8 |
| m./ Feedstock costs /natural gas/ 1. 3,5$ $10^6$kcal | $/t | 26,3 | 29,4 | 25,2 |
| 2. 5,9 $ | $/t | 44,3 | 49,6 | 42,5 |
| 3.11,8 $ | $/t | 88,5 | 99,1 | 85,0 |
| 4.17,6 $ | $/t | 132,0 | 147,8 | 126,7 |
| n./ Product value /l+m/ at factory gate 1. | $/t | 270,0 | 199,5 | 174,0 |
| 2. | $/t | 288,0 | 219,7 | 191,3 |
| 3. | $/t | 332,2 | 269,2 | 233,8 |
| 4. | $/t | 375,7 | 317,9 | 275,5 |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |
| | $/t | | | |

Product: Urea
Raw material: natural gas
Location: Developed site, West-Europe

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 260 | 440 | 1700 |
| On-stream factor | % | 90 | 90 | 90 |
| Production | kt/y | 86 | 145 | 560 |
| Total investment cost | M$ | 15,7 | 23,8 | 69,6 |
| Production cost | | | | |
| Materials | $/t | | | |
| $CO_2$ | | - | - | - |
| a./ Total materials | $/t | - | - | - |
| Utilities | $/t | | | |
| Power | " | 4,5 | 4,2 | 3,9 |
| Steam | " | 13,8 | 13,5 | 12,6 |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 1,4 | 1,4 | 1,2 |
| Steam credit | | - | - | - 0,8 |
| b./ Total utilities | $/t | 19,7 | 19,1 | 16,9 |
| c./ Labour | $/t | 3,5 | 2,1 | 0,5 |
| d./ Overhead expenses | $/t | 5,3 | 3,2 | 0,8 |
| e./ Total/a+b+c+d/ | $/t | 28,5 | 24,4 | 18,2 |
| f./ Depreciation | $/t | 18,3 | 16,4 | 12,4 |
| g./ Maintenance | $/t | 5,5 | 4,9 | 3,7 |
| h./ Insurance and property taxes | $/t | 3,7 | 3,3 | 2,5 |
| i./ Total /f+g+h/ | $/t | 27,5 | 24,6 | 18,6 |
| j./ Total production cost / e+i/ | $/t | 56,0 | 49,0 | 36,8 |
| k./ 15% R.O.I. | $/t | 27,5 | 24,6 | 18,6 |
| l./ Total /j+k/ | $/t | 83,5 | 73,6 | 55,4 |
| m./ Feedstock costs /$NH_3$/ 1. | $/t | 153,9 | 113,7 | 99,1 |
| 2. | $/t | 164,2 | 125,2 | 109,0 |
| 3. | $/t | 189,4 | 153,4 | 133,2 |
| 4. | $/t | 214,2 | 181,2 | 157,0 |
| n./ Product value /l+m/ at factory gate 1. | $/t | 237,4 | 187,3 | 154,5 |
| 2. | $/t | 247,7 | 198,8 | 164,4 |
| 3. | $/t | 272,9 | 227,0 | 188,6 |
| 4. | $/t | 297,7 | 254,8 | 212,4 |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |
| | $/t | | | |

Product: Nitric acid
Raw material: natural gas
Location: Developed site, West-Europe

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 273 | 455 | 1822 |
| On-stream factor | % | 90 | 90 | 90 |
| Production | kt/y | 90 | 150 | 600 |
| Total investment cost | M$ | 14,2 | 23,6 | 94,7 |
| Production cost | | | | |
| Materials | $/t | | | |
| Platina | | 1,7 | 1,7 | 1,7 |
| a./ Total materials | $/t | 1,7 | 1,7 | 1,7 |
| Utilities | $/t | | | |
| Power | " | 0,4 | 0,4 | 0,4 |
| Steam | " | - | - | - |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 2,2 | 2,2 | 2,2 |
| BFW | | 0,1 | 0,1 | 0,1 |
| Steam credit | | - 6,0 | - 6,0 | - 6,0 |
| b./ Total utilities | $/t | - 3,3 | - 3,3 | - 3,3 |
| c./ Labour | $/t | 1,6 | 1,0 | 0,3 |
| d./ Overhead expenses | $/t | 2,4 | 1,5 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | 2,4 | 0,9 | - 0,8 |
| f./ Depreciation | $/t | 15,8 | 15,7 | 15,8 |
| g./ Maintenance | $/t | 4,7 | 4,7 | 4,7 |
| h./ Insurance and property taxes | $/t | 3,2 | 3,2 | 3,2 |
| i./ Total /f+g+h/ | $/t | 23,7 | 23,6 | 23,7 |
| j./ Total production cost / e+i/ | $/t | 26,1 | 24,5 | 22,9 |
| k./ 15% R.O.I. | $/t | 23,7 | 23,7 | 23,7 |
| l./ Total /j+k/ | $/t | 49,8 | 48,2 | 46,6 |
| m./ Feedstock costs / $NH_3$/ | 1. $/t | 75,6 | 55,9 | 48,7 |
| | 2. $/t | 80,6 | 61,5 | 53,5 |
| | 3. $/t | 93,0 | 75,4 | 65,4 |
| | 4. $/t | 105,2 | 89,0 | 77,1 |
| n./ Product value /l+m/ at factory gate | 1. $/t | 125,4 | 104,1 | 95,3 |
| | 2. $/t | 130,4 | 109,7 | 100,1 |
| | 3. $/t | 142,8 | 123,6 | 112,0 |
| | 4. $/t | 155,0 | 137,2 | 123,7 |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t<br>$/t<br>$/t<br>$/t | - | - | - |

Product: Ammonium nitrate

Raw material: natural gas

Location: Developed site, West-Europe

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 355 | 591 | 2364 |
| On-stream factor | % | 90 | 90 | 90 |
| Production | kt/y | 117 | 195 | 780 |
| Total investment cost | M$ | 10,9 | 16,2 | 48,7 |
| Production cost | | | | |
| Materials | $/t | | | |
| lime | | 0,8 | 0,8 | 0,8 |
| coating agent | | 0,6 | 0,6 | 0,6 |
| anti-coating agent | | 1,0 | 1,0 | 1,0 |
| MgO | | 0,8 | 0,8 | 0,8 |
| a./ Total materials | $/t | 3,2 | 3,2 | 3,2 |
| Utilities | $/t | | | |
| Power | " | 0,7 | 0,7 | 0,7 |
| Steam | " | 3,6 | 3,6 | 3,6 |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 0,8 | 0,8 | 0,8 |
| b./ Total utilities | $/t | 5,1 | 5,1 | 5,1 |
| c./ Labour | $/t | 2,1 | 1,2 | 0,3 |
| d./ Overhead expenses | $/t | 3,2 | 3,0 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | 13,6 | 12,5 | 9,1 |
| f./ Depreciation | $/t | 9,3 | 8,3 | 6,2 |
| g./ Maintenance | $/t | 2,3 | 2,5 | 1,9 |
| h./ Insurance and property taxes | $/t | 1,9 | 1,7 | 1,2 |
| i./ Total /f+g+h/ | $/t | 14,0 | 12,5 | 9,3 |
| j./ Total production cost / e+i/ | $/t | 27,6 | 25,0 | 18,4 |
| k./ 15% R.O.I. | $/t | 14,0 | 12,0 | 9,3 |
| l./ Total /j+k/ | $/t | 41,6 | 37,5 | 27,7 |

| m./ Feedstock costs | | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ |
|---|---|---|---|---|---|---|---|
| 1. | $/t | 55,4 | 96,3 | 40,9 | 79,9 | 35,6 | 73,2 |
| 2. | $/t | 59,0 | 100,1 | 45,0 | 84,2 | 39,2 | 76,9 |
| 3. | $/t | 68,1 | 109,7 | 55,2 | 94,9 | 47,9 | 86,0 |
| 4. | $/t | 77,0 | 119,0 | 65,2 | 105,4 | 56,5 | 95,0 |

| n./ Product value /l+m/ at factory gate | | | | |
|---|---|---|---|---|
| 1. | $/t | 193,3 | 158,3 | 136,5 |
| 2. | $/t | 200,7 | 166,7 | 143,8 |
| 3. | $/t | 219,4 | 187,6 | 161,6 |
| 4. | $/t | 237,6 | 208,1 | 179,2 |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |
| | $/t | | | |

Product: Ammonia
Raw material: natural gas
Location: Developing site, Seaside

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 150 | 250 | 1000 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 50 | 83 | 275 |
| Total investment cost | M$ | 37 | 49,6 | 213,5 |
| Production cost | | | | |
| Materials | $/t | | | |
| Chemicals | | 8,0 | 8,0 | 8,0 |
| a./ Total materials | $/t | 8,0 | 8,0 | 8,0 |
| Utilities | $/t | | | |
| Power | " | 26,5 | - | 2,2 |
| Steam | " | - | - | - |
| BFW/demineralized/ | " | 0,9 | 0,6 | 0,6 |
| Cooling water | " | 10,3 | 6,0 | 2,4 |
| b./ Total utilities | $/t | 37,7 | 6,6 | 5,2 |
| c./ Labour | $/t | 5,1 | 3,1 | 0,9 |
| d./ Overhead expenses | $/t | 12,8 | 7,8 | 2,3 |
| e./ Total/a+b+c+d/ | $/t | 63,6 | 25,5 | 16,4 |
| f./ Depreciation | $/t | 74,0 | 59,8 | 77,6 |
| g./ Maintenance | $/t | 29,6 | 23,9 | 31,0 |
| h./ Insurance and property taxes | $/t | 22,2 | 17,9 | 23,3 |
| i./ Total /f+g+h/ | $/t | 125,8 | 101,6 | 131,9 |
| j./ Total production cost / e+i/ | $/t | 189,4 | 127,1 | 148,3 |
| k./ 15% R.O.I. | $/t | 111,0 | 89,7 | 116,4 |
| l./ Total /j+k/ | $/t | 300,4 | 216,8 | 264,7 |
| m./ Feedstock costs | | | | |
| 1,8 $ 10^6 kcal /natural gas/ 8500 kcal/kg/ | 1.$/t | 13,5 | 15,1 | 13,0 |
| 3,5 $ " | 2.$/t | 26,3 | 29,4 | 25,2 |
| 5,9 $ " | 3.$/t | 44,2 | 49,6 | 42,5 |
| 11,8 $ " | 4.$/t | 88,5 | 99,1 | 85,0 |
| n./ Product value /l+m/ at factory gate | | | | |
| | 1. $/t | 313,5 | 231,9 | 277,7 |
| | 2. $/t | 326,7 | 246,2 | 289,9 |
| | 3. $/t | 344,6 | 266,4 | 307,2 |
| | 4. $/t | 388,9 | 315,9 | 349,7 |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |
| | $/t | | | |

Appendix 3/1

Table 5-1.6

Product: Urea

Raw material: natural gas

Location: Developing site, Seaside

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 260 | 440 | 1700 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 86 | 145 | 468 |
| Total investment cost | M$ | 20,0 | 30,0 | 102,5 |
| Production cost | | | | |
| Materials | $/t | | | |
| $CO_2$ | | - | - | - |
| a./ Total materials | $/t | - | - | - |
| Utilities | $/t | | | |
| Power | " | 4,5 | 4,2 | 3,9 |
| Steam | " | 13,8 | 13,5 | 12,6 |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 1,4 | 1,4 | 1,2 |
| Steam credit | " | - | - | - 0,8 |
| b./ Total utilities | $/t | 19,7 | 19,1 | 16,9 |
| c./ Labour | $/t | 1,9 | 1,1 | 0,3 |
| d./ Overhead expenses | $/t | 4,8 | 2,8 | 0,8 |
| e./ Total/a+b+c+d/ | $/t | 26,4 | 23,0 | 18,0 |
| f./ Depreciation | $/t | 23,3 | 20,9 | 21,9 |
| g./ Maintenance | $/t | 9,3 | 8,4 | 8,8 |
| h./ Insurance and property taxes | $/t | 7,0 | 6,3 | 6,6 |
| i./ Total /f+g+h/ | $/t | 39,6 | 35,6 | 37,3 |
| j./ Total production cost / e+i/ | $/t | 66,0 | 58,6 | 55,3 |
| k./ 15% R.O.I. | $/t | 35,0 | 31,4 | 32,9 |
| l./ Total /j+k/ | $/t | 101,0 | 90,0 | 88,2 |
| m./ Feedstock costs /$NH_3$/ | 1. $/t | 178,7 | 132,2 | 158,5 |
| | 2. $/t | 186,2 | 140,3 | 165,5 |
| | 3. $/t | 196,4 | 151,9 | 175,3 |
| | 4. $/t | 221,6 | 180,1 | 199,3 |
| n./ Product value /l+m/ at factory gate | 1. $/t | 279,7 | 222,2 | 246,7 |
| | 2. $/t | 287,2 | 230,3 | 253,7 |
| | 3. $/t | 297,4 | 241,9 | 263,5 |
| | 4. $/t | 322,6 | 270,1 | 287,5 |
| o./ Distribution cost | $/t | 15,0 | 15,0 | 60,0 |
| p./ Farm-gate price /n+o/ | 1. $/t | 294,7 | 237,2 | 306,7 |
| | 2. $/t | 302,2 | 245,3 | 313,7 |
| | 3. $/t | 312,4 | 256,9 | 323,5 |
| | 4. $/t | 337,6 | 285,1 | 347,5 |

Product: Nitric acid

Raw material: natural gas

Location: Developing site, Seaside

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 273 | 455 | 1822 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 90 | 150 | 500 |
| Total investment cost | M$ | 18,0 | 30,0 | 139,5 |
| Production cost | | | | |
| Materials | $/t | 1,7 | 1,7 | 1,7 |
| a./ Total materials | $/t | 1,7 | 1,7 | 1,7 |
| Utilities | $/t | | | |
| Power | " | 0,4 | 0,4 | 0,4 |
| Steam | " | - | - | - |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 2,2 | 2,2 | 2,2 |
| BFW | | 0,1 | 0,1 | 0,1 |
| Steam credit | | - 6,0 | - 6,0 | - 6,0 |
| b./ Total utilities | $/t | - 3,3 | - 3,3 | - 3,3 |
| c./ Labour | $/t | 0,9 | 0,5 | 0,2 |
| d./ Overhead expenses | $/t | 2,3 | 1,3 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | 1,6 | 0,2 | - 0,9 |
| f./ Depreciation | $/t | 20,0 | 20,0 | 27,9 |
| g./ Maintenance | $/t | 8,0 | 8,0 | 11,2 |
| h./ Insurance and property taxes | $/t | 6,0 | 6,0 | 8,4 |
| i./ Total /f+g+h/ | $/t | 34,0 | 34,0 | 47,5 |
| j./ Total production cost / e+i/ | $/t | 35,6 | 34,2 | 46,6 |
| k./ 15% R.O.I. | $/t | 30,0 | 30,0 | 41,9 |
| l./ Total /j+k/ | $/t | 65,6 | 64,2 | 88,5 |
| m./ Feedstock costs | | | | |
| | 1. $/t | 87,8 | 65,0 | 77,9 |
| | 2. $/t | 91,5 | 68,9 | 81,3 |
| /$NH_3$/ | 3. $/t | 96,5 | 74,6 | 86,1 |
| | 4. $/t | 108,9 | 88,5 | 98,0 |
| n./ Product value /l+m/ at factory gate | 1. $/t | 153,4 | 129,2 | 166,4 |
| | 2. $/t | 157,1 | 133,1 | 169,8 |
| | 3. $/t | 162,1 | 138,8 | 174,6 |
| | 4. $/t | 174,5 | 152,7 | 186,5 |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | | | |
| | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |

Product: Ammonium nitrate

Raw material: natural gas

Location: Developing site, Seaside

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 355 | 591 | 2364 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 117 | 195 | 650 |
| Total investment cost | M$ | 13,9 | 20,5 | 71,8 |
| Production cost | | | | |
| Materials | $/t | | | |
| lime | | 0,8 | 0,8 | 0,8 |
| coating agent | | 0,6 | 0,6 | 0,6 |
| anti-coating agent | | 1,0 | 1,0 | 1,0 |
| MgO | | 0,8 | 0,8 | 0,8 |
| a./ Total materials | $/t | 3,2 | 3,2 | 3,2 |
| Utilities | $/t | | | |
| Power | " | 0,7 | 0,7 | 0,7 |
| Steam | " | 3,6 | 3,6 | 3,6 |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 0,8 | 0,8 | 0,8 |
| b./ Total utilities | $/t | 5,1 | 5,1 | 5,1 |
| c./ Labour | $/t | 1,1 | 0,7 | 0,2 |
| d./ Overhead expenses | $/t | 2,8 | 1,8 | 0,8 |
| e./ Total/a+b+c+d/ | $/t | 12,2 | 10,8 | 9,3 |
| f./ Depreciation | $/t | 11,9 | 10,5 | 11,0 |
| g./ Maintenance | $/t | 4,8 | 4,2 | 4,4 |
| h./ Insurance and property taxes | $/t | 3,6 | 3,2 | 3,3 |
| i./ Total /f+g+h/ | $/t | 20,3 | 17,9 | 18,7 |
| j./ Total production cost / e+i/ | $/t | 32,5 | 28,7 | 28,0 |
| k./ 15% R.O.I. | $/t | 17,9 | 15,8 | 16,5 |
| l./ Total /j+k/ | $/t | 50,4 | 44,5 | 44,5 |

| m./ Feedstock costs | | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ |
|---|---|---|---|---|---|---|---|
| 1. | $/t | 64,3 | 117,8 | 47,5 | 99,2 | 57,0 | 127,8 |
| 2. | $/t | 67,0 | 120,7 | 50,5 | 102,2 | 59,5 | 130,4 |
| 3. | $/t | 70,6 | 124,5 | 54,6 | 106,6 | 63,1 | 134,1 |
| 4. | $/t | 79,7 | 134,0 | 64,8 | 117,3 | 71,8 | 143,2 |

| n./ Product value /l+m/ at factory gate | | | | |
|---|---|---|---|---|
| 1. | $/t | 232,5 | 191,2 | 229,3 |
| 2. | $/t | 238,1 | 197,2 | 234,4 |
| 3. | $/t | 245,5 | 205,7 | 241,7 |
| 4. | $/t | 264,1 | 226,6 | 259,5 |
| o./ Distribution cost | $/t | 15,0 | 15,0 | 60,0 |
| p./ Farm-gate price /n+o/ | $/t | 247,5 | 206,2 | 289,3 |
| | $/t | 253,1 | 212,2 | 294,4 |
| | $/t | 260,5 | 220,7 | 301,7 |
| | $/t | 279,1 | 241,6 | 319,5 |

Product: Ammonia
Raw material: natural gas
Location: Developing site, Remote

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 150 | 250 | 1000 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 50 | 83 | 275 |
| Total investment cost | M$ | 43,0 | 58,0 | 277,4 |
| Production cost | | | | |
| Materials | $/t | | | |
| Chemicals | | 8,0 | 8,0 | 8,0 |
| a./ Total materials | $/t | 8,0 | 8,0 | 8,0 |
| Utilities | $/t | | | |
| Power | " | 26,5 | - | 2,2 |
| Steam | " | - | - | - |
| BFW/demineralized/ | " | 0,9 | 0,6 | 0,6 |
| Cooling water | " | 10,3 | 6,0 | 2,4 |
| b./ Total utilities | $/t | 37,7 | 6,6 | 5,2 |
| c./ Labour | $/t | 5,1 | 3,1 | 0,9 |
| d./ Overhead expenses | $/t | 12,8 | 7,8 | 2,3 |
| e./ Total/a+b+c+d/ | $/t | 63,6 | 25,5 | 16,4 |
| f./ Depreciation | $/t | 86,0 | 69,9 | 100,9 |
| g./ Maintenance | $/t | 34,4 | 28,0 | 40,4 |
| h./ Insurance and property taxes | $/t | 25,8 | 21,0 | 30,3 |
| i./ Total /f+g+h/ | $/t | 146,2 | 118,9 | 171,6 |
| j./ Total production cost / e+i/ | $/t | 209,8 | 144,4 | 188,0 |
| k./ 15% R.O.I. | $/t | 129,0 | 104,9 | 151,4 |
| l./ Total /j+k/ | $/t | 338,8 | 249,3 | 339,4 |
| m./ Feedstock costs | | | | |
| 1,8 $ $10^6$kcal /natural gas | 1. $/t | 13,5 | 15,1 | 13,0 |
| 3,5 $ " | 2. $/t | 26,3 | 29,4 | 25,2 |
| 5,9 $ " | 3. $/t | 44,2 | 49,6 | 42,5 |
| 8500 kcal/11,8 $ " /kg | 4. $/t | 88,5 | 99,1 | 85,0 |
| n./ Product value /l+m/ at factory gate | 1. $/t | 352,2 | 264,4 | 352,4 |
| | 2. $/t | 365,1 | 278,7 | 364,6 |
| | 3. $/t | 383,0 | 298,9 | 381,9 |
| | 4. $/t | 427,3 | 348,4 | 424,4 |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |
| | $/t | | | |

Product: Urea
Raw material: natural gas
Location: Developing site, Remote

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 260 | 440 | 1700 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 86 | 145 | 468 |
| Total investment cost | M$ | 23,4 | 35,5 | 133,2 |
| Production cost | | | | |
| Materials | $/t | | | |
| $CO_2$ | | - | - | - |
| a./ Total materials | $/t | - | - | - |
| Utilities | $/t | | | |
| Power | " | 4,5 | 4,2 | 3,9 |
| Steam | " | 13,8 | 13,5 | 12,6 |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 1,4 | 1,4 | 1,2 |
| Steam credit | " | - | - | - 0,8 |
| b./ Total utilities | $/t | 19,7 | 19,1 | 16,9 |
| c./ Labour | $/t | 1,9 | 1,1 | 0,3 |
| d./ Overhead expenses | $/t | 4,8 | 2,8 | 0,8 |
| e./ Total/a+b+c+d/ | $/t | 26,4 | 23,0 | 18,0 |
| f./ Depreciation | $/t | 27,2 | 24,5 | 28,5 |
| g./ Maintenance | $/t | 10,9 | 9,8 | 11,4 |
| h./ Insurance and property taxes | $/t | 8,2 | 7,4 | 8,6 |
| i./ Total /f+g+h/ | $/t | 46,3 | 41,7 | 48,5 |
| j./ Total production cost / e+i/ | $/t | 72,7 | 64,7 | 66,5 |
| k./ 15% R.O.I. | $/t | 40,8 | 36,8 | 42,8 |
| l./ Total /j+k/ | $/t | 113,5 | 101,5 | 109,3 |
| m./ Feedstock costs /$NH_3$/ | 1. $/t | 200,8 | 150,7 | 201,0 |
| | 2. $/t | 208,1 | 158,9 | 208,1 |
| | 3. $/t | 218,3 | 170,4 | 217,9 |
| | 4. $/t | 243,6 | 198,6 | 242,1 |
| n./ Product value /l+m/ at factory gate | 1. $/t | 314,3 | 252,2 | 310,3 |
| | 2. $/t | 321,6 | 260,4 | 317,4 |
| | 3. $/t | 331,8 | 271,9 | 327,2 |
| | 4. $/t | 357,1 | 300,1 | 351,4 |
| o./ Distribution cost | $/t | 15,0 | 15,0 | 60,0 |
| p./ Farm-gate price /n+o/ | 1. $/t | 329,3 | 267,2 | 370,3 |
| | 2. $/t | 336,6 | 275,4 | 377,4 |
| | 3. $/t | 346,8 | 286,9 | 387,2 |
| | 4. $/t | 372,1 | 315,1 | 411,4 |

Product: Nitric acid

Raw material: natural gas

Location: Developing site, Remote

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 273 | 455 | 1822 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 90 | 150 | 500 |
| Total investment cost | M$ | 21,3 | 35,1 | 181,2 |
| Production cost | | | | |
| Materials | $/t | | | |
| Platina | | 1,7 | 1,7 | 1,7 |
| a./ Total materials | $/t | 1,7 | 1,7 | 1,7 |
| Utilities | $/t | | | |
| Power | " | 0,4 | 0,4 | 0,4 |
| Steam | " | - | - | - |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 2,2 | 2,2 | 2,2 |
| BFW | | 0,1 | 0,1 | 0,1 |
| Steam credit | | - 6,0 | - 6,0 | - 6,0 |
| b./ Total utilities | $/t | - 3,3 | - 3,3 | - 3,3 |
| c./ Labour | $/t | 0,9 | 0,5 | 0,2 |
| d./ Overhead expenses | $/t | 2,3 | 1,3 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | 1,6 | 0,2 | - 0,9 |
| f./ Depreciation | $/t | 23,7 | 23,4 | 36,2 |
| g./ Maintenance | $/t | 9,5 | 9,4 | 14,5 |
| h./ Insurance and property taxes | $/t | 7,1 | 7,0 | 10,9 |
| i./ Total /f+g+h/ | $/t | 40,3 | 39,8 | 61,6 |
| j./ Total production cost / e+i/ | $/t | 41,9 | 40,0 | 60,7 |
| k./ 15% R.O.I. | $/t | 35,6 | 35,1 | 54,3 |
| l./ Total /j+k/ | $/t | 77,5 | 75,1 | 115,0 |
| m./ Feedstock costs /$NH_3$/ | 1. $/t | 98,6 | 74,0 | 98,8 |
| | 2. $/t | 102,2 | 78,0 | 102,2 |
| | 3. $/t | 107,2 | 83,7 | 107,0 |
| | 4. $/t | 119,6 | 97,6 | 118,9 |
| n./ Product value /l+m/ at factory gate | 1. $/t | 176,1 | 149,1 | 213,8 |
| | 2. $/t | 179,7 | 153,1 | 217,2 |
| | 3. $/t | 184,7 | 158,8 | 222,0 |
| | 4. $/t | 197,1 | 172,7 | 233,9 |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |
| | $/t | | | |

Product: Ammonium nitrate
Raw material: natural gas
Location: Developing site, Remote

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 355 | 591 | 2364 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 117 | 195 | 650 |
| Total investment cost | M$ | 16,2 | 24,1 | 93,2 |
| Production cost | | | | |
| Materials | $/t | | | |
| lime | | 0,8 | 0,8 | 0,8 |
| coating agent | | 0,6 | 0,6 | 0,6 |
| anti-coating agent | | 1,0 | 1,0 | 1,0 |
| MgO | | 0,8 | 0,8 | 0,8 |
| a./ Total materials | $/t | 3,2 | 3,2 | 3,2 |
| Utilities | $/t | | | |
| Power | " | 0,7 | 0,7 | 0,7 |
| Steam | " | 3,6 | 3,6 | 3,6 |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 0,8 | 0,8 | 0,8 |
| b./ Total utilities | $/t | 5,1 | 5,1 | 5,1 |
| c./ Labour | $/t | 1,1 | 0,7 | 0,2 |
| d./ Overhead expenses | $/t | 2,8 | 1,8 | 0,8 |
| e./ Total/a+b+c+d/ | $/t | 12,2 | 10,8 | 9,3 |
| f./ Depreciation | $/t | 13,8 | 12,4 | 14,3 |
| g./ Maintenance | $/t | 5,5 | 5,0 | 5,7 |
| h./ Insurance and property taxes | $/t | 4,1 | 3,7 | 4,3 |
| i./ Total /f+g+h/ | $/t | 23,4 | 21,1 | 24,3 |
| j./ Total production cost / e+i/ | $/t | 35,6 | 31,9 | 33,6 |
| k./ 15% R.O.I. | $/t | 20,7 | 18,6 | 21,5 |
| l./ Total /j+k/ | $/t | 56,3 | 50,5 | 55,1 |

| m./ Feedstock costs | | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ |
|---|---|---|---|---|---|---|---|
| 1. | $/t | 72,2 | 135,2 | 54,2 | 114,5 | 72,3 | 164,2 |
| 2. | $/t | 74,8 | 138,0 | 57,2 | 117,6 | 74,8 | 166,8 |
| 3. | $/t | 78,5 | 141,8 | 61,3 | 122,0 | 78,4 | 170,5 |
| 4. | $/t | 87,6 | 151,4 | 71,4 | 132,6 | 87,1 | 179,6 |

| n./ Product value /l+m/ at factory gate | | | | |
|---|---|---|---|---|
| 1. | $/t | 263,7 | 219,2 | 291,6 |
| 2. | $/t | 269,1 | 225,3 | 296,7 |
| 3. | $/t | 276,6 | 233,8 | 304,0 |
| 4. | $/t | 295,3 | 254,5 | 321,8 |
| o./ Distribution cost | $/t | 15,0 | 15,0 | 60,0 |
| p./ Farm-gate price /n+o/ | | | | |
| 1. | $/t | 278,7 | 234,2 | 351,6 |
| 2. | $/t | 284,1 | 240,3 | 356,7 |
| 3. | $/t | 291,6 | 248,8 | 364,0 |
| 4. | $/t | 310,3 | 269,5 | 381,8 |

Product: Ammonia
Raw material: fuel oil
Location: Developed site, West-Europe

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 150 | 250 | 1000 |
| On-stream factor | % | 90 | 90 | 90 |
| Production | kt/y | 50 | 83 | 330 |
| Total investment cost | M$ | 33,0 | 45,0 | 167,0 |
| Production cost | | | | |
| Materials | $/t | 8,0 | 8,0 | 8,0 |
| Chemicals | | | | |
| a./ Total materials | $/t | 8,0 | 8,0 | 8,0 |
| Utilities | $/t | | | |
| Power | " | 27,0 | - | 2,4 |
| Steam | " | - | - | - |
| BFW/demineralized/ | " | 1,0 | 1,0 | 1,0 |
| Cooling water | " | 11,0 | 6,4 | 3,2 |
| b./ Total utilities | $/t | 39,0 | 7,4 | 6,6 |
| c./ Labour | $/t | 12,0 | 7,2 | 1,8 |
| d./ Overhead expenses | $/t | 18,0 | 10,8 | 2,7 |
| e./ Total/a+b+c+d/ | $/t | 77,0 | 33,4 | 19,1 |
| f./ Depreciation | $/t | 66,0 | 54,2 | 50,6 |
| g./ Maintenance | $/t | 19,8 | 16,3 | 15,2 |
| h./ Insurance and property taxes | $/t | 13,2 | 10,8 | 10,1 |
| i./ Total /f+g+h/ | $/t | 99,0 | 81,3 | 75,9 |
| j./ Total production cost / e+i/ | $/t | 176,0 | 114,7 | 95,0 |
| k./ 15% R.O.I. | $/t | 99,0 | 81,3 | 75,9 |
| l./ Total /j+k/ | $/t | 275,0 | 196,0 | 170,9 |
| m./ Feedstock costs | | | | |
| /Fuel oil/ 15 $/10$^6$ kcal 1. | $/t | 117,0 | 130,5 | 123,6 |
| 18 $/10$^6$ kcal 2. | $/t | 140,4 | 156,6 | 148,3 |
| | $/t | | | |
| | $/t | | | |
| n./ Product value /l+m/ | | | | |
| at factory gate 1. | $/t | 392,0 | 326,5 | 394,5 |
| 2. | $/t | 415,4 | 352,6 | 319,2 |
| | $/t | | | |
| | $/t | | | |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |
| | $/t | | | |

Product: Urea
Raw material: fuel oil
Location: Developed site, West-Europe

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 260 | 440 | 1700 |
| On-stream factor | % | 90 | 90 | 90 |
| Production | kt/y | 86 | 145 | 560 |
| Total investment cost | MØ | 15,7 | 23,8 | 69,6 |
| Production cost | | | | |
| Materials | Ø/t | | | |
| $CO_2$ | | - | - | - |
| a./ Total materials | Ø/t | - | - | - |
| Utilities | Ø/t | | | |
| Power | " | 4,5 | 4,2 | 3,9 |
| Steam | " | 13,8 | 13,5 | 12,6 |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 1,4 | 1,4 | 1,2 |
| Steam credit | " | - | - | - 0,8 |
| b./ Total utilities | Ø/t | 19,7 | 19,1 | 16,9 |
| c./ Labour | Ø/t | 3,5 | 2,1 | 0,5 |
| d./ Overhead expenses | Ø/t | 5,3 | 3,2 | 0,8 |
| e./ Total/a+b+c+d/ | Ø/t | 28,5 | 24,4 | 18,2 |
| f./ Depreciation | Ø/t | 18,3 | 16,4 | 12,4 |
| g./ Maintenance | Ø/t | 5,5 | 4,9 | 3,7 |
| h./ Insurance and property taxes | Ø/t | 3,7 | 3,3 | 2,5 |
| i./ Total /f+g+h/ | Ø/t | 27,5 | 24,6 | 18,6 |
| j./ Total production cost / e+i/ | Ø/t | 56,0 | 49,0 | 36,8 |
| k./ 15% R.O.I. | Ø/t | 27,5 | 24,6 | 18,6 |
| l./ Total /j+k/ | Ø/t | 83,5 | 73,6 | 55,4 |
| m./ Feedstock costs /$NH_3$/ | 1. Ø/t | 223,4 | 186,1 | 167,8 |
| | 2. Ø/t | 236,8 | 201,0 | 181,9 |
| | Ø/t | | | |
| | Ø/t | | | |
| n./ Product value /l+m/ at factory gate | 1. Ø/t | 306,9 | 259,7 | 223,2 |
| | 2. Ø/t | 320,3 | 274,6 | 237,3 |
| | Ø/t | | | |
| | Ø/t | | | |
| o./ Distribution cost | Ø/t | - | - | - |
| p./ Farm-gate price /n+o/ | Ø/t | - | - | - |
| | Ø/t | | | |
| | Ø/t | | | |
| | Ø/t | | | |

Product: Nitric acid
Raw material: fuel oil
Location: Developed site, West-Europe

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 273 | 455 | 1922 |
| On-stream factor | % | 90 | 90 | 90 |
| Production | kt/y | 90 | 150 | 600 |
| Total investment cost | M$ | 14,2 | 23,6 | 94,7 |
| Production cost | | | | |
| Materials | $/t | 1,7 | 1,7 | 1,7 |
| a./ Total materials | $/t | 1,7 | 1,7 | 1,7 |
| Utilities | $/t | | | |
| Power | " | 0,4 | 0,4 | 0,4 |
| Steam | " | - | - | - |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 2,2 | 2,2 | 2,2 |
| BFW | | 0,1 | 0,1 | 0,1 |
| Steam credit | | - 6,0 | - 6,0 | - 6,0 |
| b./ Total utilities | $/t | - 3,3 | - 3,3 | - 3,3 |
| c./ Labour | $/t | 1,6 | 1,0 | 0.5 |
| d./ Overhead expenses | $/t | 2,4 | 1,5 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | 2,4 | 0,9 | - 0,8 |
| f./ Depreciation | $/t | 15,8 | 15,7 | 15,8 |
| g./ Maintenance | $/t | 4,7 | 4,7 | 4,7 |
| h./ Insurance and property taxes | $/t | 3,2 | 3,2 | 3,2 |
| i./ Total /f+g+h/ | $/t | 23,7 | 23,6 | 23,7 |
| j./ Total production cost / e+i/ | $/t | 26,1 | 24,5 | 22,9 |
| k./ 15% R.O.I. | $/t | 23,7 | 23,7 | 23,7 |
| l./ Total /j+k/ | $/t | 49,8 | 48,2 | 46,6 |
| m./ Feedstock costs /$NH_3$/ 1. | $/t | 109,8 | 91,4 | 82,4 |
| 2. | $/t | 116,3 | 98,7 | 89,3 |
| | $/t | | | |
| | $/t | | | |
| n./ Product value /l+m/ at factory gate 1. | $/t | 159,6 | 139,6 | 129,0 |
| 2. | $/t | 166,1 | 146,9 | 135,9 |
| | $/t | | | |
| | $/t | | | |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | | | |
| | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |

Product: Ammonium nitrate

Raw material: fuel oil

Location: Developed site, West-Europe

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 355 | 591 | 2364 |
| On-stream factor | % | 90 | 90 | 90 |
| Production | kt/y | 117 | 195 | 780 |
| Total investment cost | M$ | 10,9 | 16,2 | 48,7 |
| Production cost | | | | |
| Materials | $/t | | | |
| lime | " | 0,8 | 0,8 | 0,8 |
| coating agent | " | 0,6 | 0,6 | 0,6 |
| anti-coating agent | " | 1,0 | 1,0 | 1,0 |
| MgO | " | 0,8 | 0,8 | 0,8 |
| a./ Total materials | $/t | 3,2 | 3,2 | 3,2 |
| Utilities | $/t | | | |
| Power | " | 0,7 | 0,7 | 0,7 |
| Steam | " | 3,6 | 3,6 | 3,6 |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 0,8 | 0,8 | 0,8 |
| b./ Total utilities | $/t | 5.1 | 5.1 | 5.1 |
| c./ Labour | $/t | 2,1 | 1,2 | 0,3 |
| d./ Overhead expenses | $/t | 3,2 | 3,0 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | 13,6 | 12,5 | 9,1 |
| f./ Depreciation | $/t | 9,3 | 8,3 | 6,2 |
| g./ Maintenance | $/t | 2,8 | 2,5 | 1,9 |
| h./ Insurance and property tnxes | $/t | 1,9 | 1,7 | 1,2 |
| i./ Total /f+g+h/ | $/t | 14,0 | 12,5 | 9,3 |
| j./ Total production cost / e+i/ | $/t | 27,6 | 25,0 | 18,4 |
| k./ 15% R.O.I. | $/t | 14,0 | 12,5 | 9,3 |
| l./ Total /j+k/ | $/t | 41,6 | 37,5 | 27,7 |

| m./ Feedstock costs | | | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ |
|---|---|---|---|---|---|---|---|---|
| | 1. | $/t | 80,4 | 122,6 | 66,9 | 107,2 | 60,3 | 99,1 |
| | 2. | $/t | 85,2 | 127,6 | 72,2 | 112,8 | 65,4 | 104,4 |
| | | $/t | | | | | | |
| | | $/t | | | | | | |

| n./ Product value /l+m/ at factory gate | | | | | |
|---|---|---|---|---|---|
| | 1. | $/t | 244,6 | 211,6 | 187,1 |
| | 2. | $/t | 254,4 | 222,5 | 197,5 |
| | | $/t | | | |
| | | $/t | | | |
| o./ Distribution cost | | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | | $/t | - | - | - |
| | | $/t | | | |
| | | $/t | | | |
| | | $/t | | | |

Table 5-1.17

Product: Ammonia

Raw material: fuel oil

Location: Developing site, Seaside

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 150 | 250 | 1000 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 50 | 83 | 275 |
| Total investment cost | M$ | 42,0 | 57,0 | 246,0 |
| Production cost | | | | |
| Materials | $/t | | | |
| Chemicals | " | 8,0 | 8,0 | 8,0 |
| a./ Total materials | $/t | 8,0 | 8,0 | 8,0 |
| Utilities | $/t | | | |
| Power | " | 27,0 | - | 2,4 |
| Steam | " | - | -- | - |
| BFW/demineralized/ | " | 1,0 | 1,0 | 1,0 |
| Cooling water | " | 11,0 | 6,4 | 3,2 |
| b./ Total utilities | $/t | 39,0 | 7,4 | 6,6 |
| c./ Labour | $/t | 6,4 | 3,9 | 1,2 |
| d./ Overhead expenses | $/t | 16,0 | 9,8 | 3,0 |
| e./ Total/a+b+c+d/ | $/t | 69,4 | 29,1 | 18,8 |
| f./ Depreciation | $/t | 84,0 | 68,7 | 89,5 |
| g./ Maintenance | $/t | 33,6 | 27,5 | 35,8 |
| h./ Insurance and property taxes | $/t | 25,2 | 20,6 | 26,9 |
| i./ Total /f+g+h/ | $/t | 142,8 | 116,8 | 152,2 |
| j./ Total production cost / e+i/ | $/t | 212,2 | 145,9 | 171,0 |
| k./ 15% R.O.I. | $/t | 126,0 | 103,1 | 134,3 |
| l./ Total /j+k/ | $/t | 338,2 | 249,0 | 305,3 |
| m./ Feedstock costs | | | | |
| /fuel oil/ 12 $/10^6 kcal | 1. $/t | 93,6 | 104,4 | 98,9 |
| /fuel oil/ 15 " | 2. $/t | 117,0 | 130,5 | 123,6 |
| | $/t | | | |
| | $/t | | | |
| n./ Product value /l+m/ at factory gate | 1. $/t | 431,8 | 353,4 | 404,2 |
| | 2. $/t | 455,2 | 379,5 | 428,9 |
| | $/t | | | |
| | $/t | | | |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |
| | $/t | | | |

Product: Urea

Raw material: fuel oil

Location: Developing site, Seaside

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 260 | 440 | 1700 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 86 | 145 | 468 |
| Total investment cost | M$ | 20,0 | 30,3 | 102,5 |
| Production cost | | | | |
| Materials | $/t | | | |
| $CO_2$ | | - | - | - |
| a./ Total materials | $/t | - | - | - |
| Utilities | $/t | | | |
| Power | " | 4,5 | 4,2 | 3,9 |
| Steam | " | 13,8 | 13,5 | 12,6 |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 1,4 | 1,4 | 1,2 |
| Steam credit | " | - | - | - 0,8 |
| b./ Total utilities | $/t | 19,7 | 19,1 | 16,9 |
| c./ Labour | $/t | 1,9 | 1,1 | 0,3 |
| d./ Overhead expenses | $/t | 4,8 | 2,8 | 0,8 |
| e./ Total/a+b+c+d/ | $/t | 26,4 | 23,0 | 18,0 |
| f./ Depreciation | $/t | 23,3 | 20,9 | 21,9 |
| g./ Maintenance | $/t | 9,3 | 8,4 | 8,8 |
| h./ Insurance and property taxes | $/t | 7,0 | 6,3 | 6,6 |
| i./ Total /f+g+h/ | $/t | 39,6 | 35,6 | 37,3 |
| j./ Total production cost / e+i/ | $/t | 66,0 | 58,6 | 55,3 |
| k./ 15% R.O.I. | $/t | 35,0 | 31,4 | 32,9 |
| l./ Total /j+k/ | $/t | 101,0 | 90,0 | 88,2 |
| m./ Feedstock costs /$NH_3$/ 1. | $/t | 246,1 | 201,4 | 230,4 |
| 2. | $/t | 259,5 | 216,3 | 244,5 |
| | $/t | | | |
| | $/t | | | |
| n./ Product value /l+m/ at factory gate 1. | $/t | 347,1 | 291,4 | 318,6 |
| 2. | $/t | 360,5 | 306,3 | 332,7 |
| | $/t | | | |
| | $/t | | | |
| o./ Distribution cost | $/t | 15,0 | 15,0 | 60,0 |
| p./ Farm-gate price /n+o/ 1. | $/t | 362,1 | 306,4 | 378,6 |
| 2. | $/t | 375,5 | 321,3 | 392,7 |
| | $/t | | | |
| | $/t | | | |

Product: Nitric acid

Raw material: fuel oil

Location: Developing site, Seaside

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 273 | 255 | 1822 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 90 | 150 | 500 |
| Total investment cost | M$ | 18,0 | 30,0 | 139,5 |
| Production cost | | | | |
| Materials | $/t | | | |
| Platina | | 1,7 | 1,7 | 1,7 |
| a./ Total materials | $/t | 1,7 | 1,7 | 1,7 |
| Utilities | $/t | | | |
| Power | " | 0,4 | 0,4 | 0,4 |
| Steam | " | - | - | - |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 2,2 | 2,2 | 2,2 |
| BFW | | 0,1 | 0,1 | 0,1 |
| Steam credit | | - 6,0 | - 6,0 | - 6,0 |
| b./ Total utilities | $/t | - 3,3 | - 3,3 | - 3,3 |
| c./ Labour | $/t | 0,9 | 0,5 | 0,2 |
| d./ Overhead expenses | $/t | 2,3 | 1,3 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | 1,6 | 0,2 | - 0,9 |
| f./ Depreciation | $/t | 20,0 | 20,0 | 27,9 |
| g./ Maintenance | $/t | 8,0 | 8,0 | 11,2 |
| h./ Insurance and property taxes | $/t | 6,0 | 6,0 | 8,4 |
| i./ Total /f+g+h/ | $/t | 34,0 | 34,0 | 47,5 |
| j./ Total production cost / e+i/ | $/t | 35,6 | 34,2 | 46,6 |
| k./ 15% R.O.I. | $/t | 30,0 | 30,0 | 41,9 |
| l./ Total /j+k/ | $/t | 65,6 | 64,2 | 88,5 |
| m./ Feedstock costs /$NH_3$/ 1. | $/t | 120,9 | 99,0 | 113,2 |
| 2. | $/t | 127,5 | 106,3 | 120,1 |
| | $/t | | | |
| | $/t | | | |
| n./ Product value /l+m/ at factory gate 1. | $/t | 186,5 | 163,2 | 201,7 |
| 2. | $/t | 193,1 | 170,5 | 208,6 |
| | $/t | | | |
| | $/t | | | |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |
| | $/t | | | |

Product: Ammonium nitrate

Raw material: fuel oil

Location: Developing site, Seaside

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 355 | 591 | 2364 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 117 | 195 | 650 |
| Total investment cost | M$ | 13,9 | 20,5 | 71,8 |
| Production cost | | | | |
| Materials | $/t | | | |
| lime | | 0,8 | 0,8 | 0,8 |
| coating agent | | 0,6 | 0,6 | 0,6 |
| anti-caking agent | | 1,0 | 1,0 | 1,0 |
| MgO | | 0,8 | 0,8 | 0,8 |
| a./ Total materials | $/t | 3,2 | 3,2 | 3,2 |
| Utilities | $/t | | | |
| Power | " | 0,7 | 0,7 | 0,7 |
| Steam | " | 3,6 | 3,6 | 3,6 |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 0,8 | 0,8 | 0,8 |
| b./ Total utilities | $/t | 5,1 | 5,1 | 5,1 |
| c./ Labour | $/t | 1,1 | 0,7 | 0,2 |
| d./ Overhead expenses | $/t | 2,8 | 1,8 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | 12,2 | 10,8 | 9,0 |
| f./ Depreciation | $/t | 11,9 | 10,5 | 11,0 |
| g./ Maintenance | $/t | 4,8 | 4,2 | 4,4 |
| h./ Insurance and property taxes | $/t | 3,6 | 3,2 | 3,3 |
| i./ Total /f+g+h/ | $/t | 20,3 | 17,9 | 18,7 |
| j./ Total production cost / e+i/ | $/t | 32,5 | 28,7 | 27,7 |
| k./ 15% R.O.I. | $/t | 17,9 | 15,8 | 16,5 |
| l./ Total /j+k/ | $/t | 50,4 | 44,5 | 44,2 |

| m./ Feedstock costs | | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ |
|---|---|---|---|---|---|---|---|
| 1. | $/t | 88,5 | 143,2 | 72,4 | 125,3 | 82,9 | 154,9 |
| 2. | $/t | 93,3 | 148,3 | 77,8 | 130,9 | 87,9 | 160,2 |
| | $/t | | | | | | |
| | $/t | | | | | | |

| n./ Product value /l+m/ at factory gate | | | | |
|---|---|---|---|---|
| 1. | $/t | 282,1 | 242,2 | 282,0 |
| 2. | $/t | 292,0 | 253,2 | 292,3 |
| | $/t | | | |
| | $/t | | | |
| o./ Distribution cost | $/t | 15,0 | 15,0 | 60,0 |
| p./ Farm-gate price /n+o/ 1. | $/t | 282,1 | 242,2 | 282,0 |
| 2. | $/t | 292,0 | 253,2 | 292,3 |
| | $/t | | | |
| | $/t | | | |

Product: Ammonia

Raw material: fuel oil

Location: Developing site, Remote

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 150 | 150 | 1000 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 50 | 83 | 275 |
| Total investment cost | M$ | 49,0 | 67,0 | 320,0 |
| Production cost | | | | |
| Materials | $/t | | | |
| Chemicals | | 8,0 | 8,0 | 8,0 |
| a./ Total materials | $/t | 8,0 | 8,0 | 8,0 |
| Utilities | $/t | | | |
| Power | " | 27,0 | - | 2,4 |
| Steam | " | - | - | - |
| BFW/demineralized/ | " | 1,0 | 1,0 | 1,0 |
| Cooling water | " | 11,0 | 6,4 | 3,2 |
| b./ Total utilities | $/t | 39,0 | 7,4 | 6,6 |
| c./ Labour | $/t | 6,4 | 3,9 | 1,2 |
| d./ Overhead expenses | $/t | 16,0 | 9,8 | 3,0 |
| e./ Total/a+b+c+d/ | $/t | 69,4 | 29,1 | 18,8 |
| f./ Depreciation | $/t | 98,0 | 80,7 | 116,4 |
| g./ Maintenance | $/t | 39,2 | 32,3 | 46,6 |
| h./ Insurance and property taxes | $/t | 29,4 | 24,2 | 34,9 |
| i./ Total /f+g+h/ | $/t | 166,6 | 137,2 | 197,9 |
| j./ Total production cost / e+i/ | $/t | 236,0 | 166,3 | 216,7 |
| k./ 15% R.O.I. | $/t | 147,0 | 121,0 | 174,6 |
| l./ Total /j+k/ | $/t | 383,0 | 287,3 | 391,3 |
| m./ Feedstock costs | | | | |
| /fuel oil/ 12 $/$10^6$ kcal | 1. $/t | 99,6 | 104,4 | 98,9 |
| /fuel oil/ 15 $ " | 2. $/t | 117,0 | 130,5 | 123,6 |
| | $/t | | | |
| | $/t | | | |
| n./ Product value /l+m/ at factory gate | 1. $/t | 476,6 | 391,7 | 490,2 |
| | 2. $/t | 500,0 | 417,8 | 514,9 |
| | $/t | | | |
| | $/t | | | |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | | | |
| | $/t | | | |
| | $/t | | | |
| | $/t | | | |

Product: Urea

Raw material: fuel oil

Location: Developing site, Remote

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 260 | 440 | 1700 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 86 | 145 | 468 |
| Total investment cost | M$ | 23,4 | 35,5 | 133,2 |
| Production cost | | | | |
| Materials | $/t | | | |
| $CO_2$ | | - | - | - |
| a./ Total materials | $/t | - | - | - |
| Utilities | $/t | | | |
| Power | " | 4,5 | 4,2 | 3,9 |
| Steam | " | 13,8 | 13,5 | 12,6 |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 1,4 | 1,4 | 1,2 |
| Steam credit | | - | - | - 0,8 |
| b./ Total utilities | $/t | 19,7 | 19,1 | 16,9 |
| c./ Labour | $/t | 1,9 | 1,1 | 0,3 |
| d./ Overhead expenses | $/t | 4,8 | 2,8 | 0,8 |
| e./ Total/a+b+c+d/ | $/t | 26,4 | 23,0 | 18,0 |
| f./ Depreciation | $/t | 27,2 | 24,5 | 28,5 |
| g./ Maintenance | $/t | 10,9 | 9,8 | 11,4 |
| h./ Insurance and property taxes | $/t | 8,2 | 7,4 | 8,6 |
| i./ Total /f+g+h/ | $/t | 46,3 | 41,7 | 48,5 |
| j./ Total production cost / e+i/ | $/t | 72,7 | 64,7 | 66,5 |
| k./ 15% R.O.I. | $/t | 40,8 | 36,8 | 42,8 |
| l./ Total /j+k/ | $/t | 113,5 | 101,5 | 109,3 |
| m./ Feedstock costs /$NH_3$/ | 1. $/t | 271,6 | 223,3 | 279,4 |
| | 2. $/t | 285,0 | 238,2 | 293,5 |
| | $/t | | | |
| | $/t | | | |
| n./ Product value /l+m/ at factory gate | 1. $/t | 385,1 | 324,8 | 388,7 |
| | 2. $/t | 398,5 | 339,7 | 402,8 |
| | $/t | | | |
| | $/t | | | |
| o./ Distribution cost | $/t | 15,0 | 15,0 | 60,0 |
| p./ Farm-gate price /n+o/ | 1. $/t | 400,1 | 339,8 | 448,7 |
| | 2. $/t | 413,5 | 354,7 | 462,8 |
| | $/t | | | |
| | $/t | | | |

Appendix 3/1

Table 5-1.23

Product: Nitric acid

Raw material: fuel oil

Location: Developing site, Remote

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 273 | 455 | 1822 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 90 | 150 | 500 |
| Total investment cost | M$ | | | |
| Production cost | | 21,3 | 35,1 | 181,2 |
| Materials | $/t | | | |
| Platins | | 1,7 | 1,7 | 1,7 |
| a./ Total materials | $/t | 1,7 | 1,7 | 1,7 |
| Utilities | $/t | | | |
| Power | " | 0,4 | 0,4 | 0,4 |
| Steam | " | - | - | - |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 2,2 | 2,2 | 2,2 |
| BFW | | 0,1 | 0,1 | 0,1 |
| Steam credit | | - 6,0 | - 6,0 | - 6,0 |
| b./ Total utilities | $/t | - 3,3 | - 3,3 | - 3,3 |
| c./ Labour | $/t | 0,9 | 0,5 | 0,2 |
| d./ Overhead expenses | $/t | 2,3 | 1,3 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | 1,6 | 0,2 | - 0,9 |
| f./ Depreciation | $/t | 23,7 | 23,4 | 36,2 |
| g./ Maintenance | $/t | 9,5 | 9,4 | 14,5 |
| h./ Insurance and property taxes | $/t | 7,1 | 7,0 | 10,9 |
| i./ Total /f+g+h/ | $/t | 40,3 | 39,8 | 61,6 |
| j./ Total production cost / e+i/ | $/t | 41,9 | 40,0 | 60,7 |
| k./ 15% R.O.I. | $/t | 35,6 | 35,1 | 54,3 |
| l./ Total /j+k/ | $/t | 77,5 | 75,1 | 115,0 |
| m./ Feedstock costs | | | | |
| /$NH_3$/ 1. | $/t | 133,4 | 109,7 | 137,2 |
| 2. | $/t | 140,0 | 117,0 | 144,2 |
| | $/t | | | |
| | $/t | | | |
| n./ Product value /l+m/ at factory gate 1. | $/t | 210,9 | 184,8 | 252,3 |
| | $/t | | | |
| 2. | $/t | 217,5 | 192,1 | 259,2 |
| | $/t | | | |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | | | |
| | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |

Product: Ammonium nitrate
Raw material: fuel oil
Location: Developing site, Remote

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 355 | 591 | 2364 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 117 | 195 | 650 |
| Total investment cost | M$ | 16,2 | 24,1 | 93,2 |
| Production cost | | | | |
| Materials | $/t | | | |
| lime | | 0,8 | 0,8 | 0,8 |
| coating agent | | 0,6 | 0,6 | 0,6 |
| anti-coating agent | | 1,0 | 1,0 | 1,0 |
| MgO | | 0,8 | 0,8 | 0,8 |
| a./ Total materials | $/t | 3,2 | 3,2 | 3,2 |
| Utilities | $/t | | | |
| Power | " | 0,7 | 0,7 | 0,7 |
| Steam | " | 3,6 | 3,6 | 3,6 |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 0,8 | 0,8 | 0,8 |
| b./ Total utilities | $/t | 5,1 | 5,1 | 5,1 |
| c./ Labour | $/t | 1,1 | 0,7 | 0,2 |
| d./ Overhead expenses | $/t | 2,8 | 1,8 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | 12,2 | 10,8 | 9,0 |
| f./ Depreciation | $/t | 13,8 | 12,4 | 14,3 |
| g./ Maintenance | $/t | 5,5 | 5,0 | 5,7 |
| h./ Insurance and property taxes | $/t | 4,1 | 3,7 | 4,3 |
| i./ Total /f+g+h/ | $/t | 23,4 | 21,1 | 24,3 |
| j./ Total production cost / e+i/ | $/t | 35,6 | 31,9 | 33,3 |
| k./ 15% R.O.I. | $/t | 20,7 | 18,6 | 21,5 |
| l./ Total /j+k/ | $/t | 56,3 | 50,5 | 54,8 |

| m./ Feedstock costs | | | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ |
|---|---|---|---|---|---|---|---|---|
| | 1. | $/t | 97,7 | 162,0 | 80,3 | 141,8 | 100,5 | 193,8 |
| | 2. | $/t | 102,5 | 167,0 | 85,6 | 147,5 | 105,6 | 199,1 |
| | | $/t | | | | | | |
| | | $/t | | | | | | |

| n./ Product value /l+m/ at factory gate | | | | | |
|---|---|---|---|---|---|
| | 1. | $/t | 375,6 | 321,1 | 382,7 |
| | 2. | $/t | 385,5 | 332,0 | 393,2 |
| | | $/t | | | |
| | | $/t | | | |
| o./ Distribution cost | | $/t | 15,0 | 15,0 | 60,0 |
| p./ Farm-gate price /n+o/ | 1. | $/t | 316,0 | 272,6 | 349,1 |
| | 2. | $/t | 325,8 | 283,6 | 359,5 |
| | | $/t | | | |
| | | $/t | | | |

Product: Ammonia
Raw material: coal
Location: Developed site, West-Europe

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 150 | 250 | 1000 |
| On-stream factor | % | 90 | 90 | 90 |
| Production | kt/y | 50 | 83 | 330 |
| Total investment cost | M$ | 46,0 | 62,0 | 232,0 |
| Production cost | | | | |
| Materials | $/t | | | |
| Chemicals | | 8,0 | 8,0 | 8,0 |
| a./ Total materials | $/t | 8,0 | 8,0 | 8,0 |
| Utilities | $/t | | | |
| Power | " | 33,0 | - | 3,0 |
| Steam | " | - | - | - |
| BFW/demineralized/ | " | 1,8 | 1,5 | 1,5 |
| Cooling water | " | 16,0 | 6,9 | 3,4 |
| b./ Total utilities | $/t | 50,8 | 8,4 | 7,9 |
| c./ Labour | $/t | 18,0 | 10,8 | 2,9 |
| d./ Overhead expenses | $/t | 27,0 | 16,2 | 4,4 |
| e./ Total/a+b+c+d/ | $/t | 103,8 | 43,4 | 23,2 |
| f./ Depreciation | $/t | 92,0 | 74,7 | 70,3 |
| g./ Maintenance | $/t | 27,6 | 22,4 | 21,1 |
| h./ Insurance and property taxes | $/t | 18,4 | 15,0 | 14,1 |
| i./ Total /f+g+h/ | $/t | 138,0 | 112,1 | 105,5 |
| j./ Total production cost / e+i/ | $/t | 241,8 | 155,5 | 128,7 |
| k./ 15% R.O.I. | $/t | 138,0 | 112,1 | 105,5 |
| l./ Total /j+k/ | $/t | 379,8 | 267,6 | 234,2 |
| m./ Feedstock costs | | | | |
| /coal/ 6,8 $/$10^6$ kcal | 1. $/t | 81,6 | 87,0 | 70,0 |
| 13,6 $ " | 2. $/t | 163,2 | 174,0 | 140,1 |
| 22,7 $ " | 3. $/t | 272,4 | 290,6 | 233,8 |
| | $/t | | | |
| n./ Product value /l+m/ at factory gate | 1. $/t | 461,4 | 354,6 | 304,2 |
| | 2. $/t | 543,0 | 441,6 | 374,3 |
| | 3. $/t | 652,2 | 558,2 | 468,0 |
| | $/t | | | |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |
| | $/t | | | |

Appendix 3/1

Table 5-1.26

Product: Urea

Raw material: coal

Location: Developed site, West-Europe

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 260 | 440 | 1700 |
| On-stream factor | % | 90 | 90 | 90 |
| Production | kt/y | 86 | 145 | 560 |
| Total investment cost | M$ | 15,7 | 23,8 | 69,6 |
| Production cost | | | | |
| Materials | $/t | | | |
| a./ Total materials | $/t | | | |
| Utilities | $/t | | | |
| Power | " | 4,5 | 4,2 | 3,9 |
| Steam | " | 13,8 | 13,5 | 12,6 |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 1,4 | 1,4 | 1,2 |
| Steam credit | | - | - | - 0,8 |
| b./ Total utilities | $/t | 19,7 | 19,1 | 16,9 |
| c./ Labour | $/t | 3,5 | 2,1 | 0,5 |
| d./ Overhead expenses | $/t | 5,3 | 3,2 | 0,8 |
| e./ Total/a+b+c+d/ | $/t | 28,5 | 24,4 | 18,2 |
| f./ Depreciation | $/t | 18,3 | 16,4 | 12,4 |
| g./ Maintenance | $/t | 5,5 | 4,9 | 3,7 |
| h./ Insurance and property taxes | $/t | 3,7 | 3,3 | 2,5 |
| i./ Total /f+g+h/ | $/t | 27,5 | 24,6 | 18,6 |
| j./ Total production cost / e+i/ | $/t | 56,0 | 49,0 | 36,8 |
| k./ 15% R.O.I. | $/t | 27,5 | 24,6 | 18,6 |
| l./ Total /j+k/ | $/t | 83,5 | 73,6 | 55,4 |
| m./ Feedstock costs /$NH_3$/ | 1. $/t | 263,0 | 202,1 | 173,4 |
| | 2. $/t | 309,5 | 251,7 | 213,4 |
| | 3. $/t | 372,0 | 318,2 | 266,8 |
| | $/t | | | |
| n./ Product value /l+m/ at factory gate | 1. $/t | 346,5 | 275,7 | 228,8 |
| | 2. $/t | 393,0 | 325,3 | 268,8 |
| | 3. $/t | 455,5 | 391,8 | 322,2 |
| | $/t | | | |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |
| | $/t | | | |

Product: Nitric acid

Raw material: coal

Location: Developed site, West-Europe

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 273 | 455 | 1822 |
| On-stream factor | % | 90 | 90 | 90 |
| Production | kt/y | 90 | 150 | 600 |
| Total investment cost | M$ | 14,2 | 23,6 | 94,7 |
| Production cost | | | | |
| Materials | $/t | | | |
| Platins | | 1,7 | 1,7 | 1,7 |
| a./ Total materials | $/t | 1,7 | 1,7 | 1,7 |
| Utilities | $/t | | | |
| Power | " | 0,4 | 0,4 | 0,4 |
| Steam | " | - | - | - |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 2,2 | 2,2 | 2,2 |
| BFW | | 0,1 | 0,1 | 0,1 |
| Steam credit | | - 6,0 | - 6,0 | - 6,0 |
| b./ Total utilities | $/t | - 3,3 | - 3,3 | - 3,3 |
| c./ Labour | $/t | 1,6 | 1,0 | 0,3 |
| d./ Overhead expenses | $/t | 2,4 | 1,5 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | 2,4 | 0,9 | - 0,8 |
| f./ Depreciation | $/t | 15,8 | 15,7 | 15,8 |
| g./ Maintenance | $/t | 4,7 | 4,7 | 4,7 |
| h./ Insurance and property taxes | $/t | 3,2 | 3,2 | 3,2 |
| i./ Total /f+g+h/ | $/t | 23,7 | 23,6 | 23,7 |
| j./ Total production cost / e+i/ | $/t | 26,1 | 24,5 | 22,9 |
| k./ 15% R.O.I. | $/t | 23,7 | 23,7 | 23,7 |
| l./ Total /j+k/ | $/t | 49,8 | 48,2 | 46,6 |
| m./ Feedstock costs | | | | |
| /$NH_3$/ 1. | $/t | 129,2 | 99,3 | 85,2 |
| 2. | $/t | 152,0 | 123,6 | 104,8 |
| 3. | $/t | 182,6 | 156,3 | 131,0 |
| | $/t | | | |
| n./ Product value /l+m/ at factory gate 1. | $/t | 179,0 | 147,5 | 131,8 |
| 2. | $/t | 201,8 | 171,8 | 151,4 |
| 3. | $/t | 232,4 | 204,5 | 177,6 |
| | $/t | | | |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |
| | $/t | | | |

Appendix 3/1

Table 5-1.28

Product: Ammonium nitrate

Raw material: coal

Location: Developed site, West-Europe

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 355 | 591 | 2364 |
| On-stream factor | % | 90 | 90 | 90 |
| Production | kt/y | 117 | 195 | 780 |
| Total investment cost | M$ | 10,9 | 16,2 | 48,7 |
| Production cost | | | | |
| Materials | $/t | | | |
| lime | | 0,8 | 0,8 | 0,8 |
| cooling agent | | 0,6 | 0,6 | 0,6 |
| anti-caking agent | | 1,0 | 1,0 | 1,0 |
| MgO | | 0,8 | 0,8 | 0,8 |
| a./ Total materials | $/t | 3,2 | 3,2 | 3,2 |
| Utilities | $/t | | | |
| Power | " | 0,7 | 0,7 | 0,7 |
| Steam | " | 3,6 | 3,6 | 3,6 |
| BFW/demineralized/ | " | | | |
| Cooling water | " | 0,8 | 0,8 | 0,8 |
| b./ Total utilities | $/t | 5,1 | 5,1 | 5,1 |
| c./ Labour | $/t | 2,1 | 1,2 | 0,3 |
| d./ Overhead expenses | $/t | 3,2 | 3,0 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | 13,6 | 12,5 | 9,1 |
| f./ Depreciation | $/t | 9,3 | 8,3 | 6,2 |
| g./ Maintenance | $/t | 2,8 | 2,5 | 1,9 |
| h./ Insurance and property taxes | $/t | 1,9 | 1,7 | 1,2 |
| i./ Total /f+g+h/ | $/t | 14,0 | 12,5 | 9,3 |
| j./ Total production cost / e+i/ | $/t | 27,6 | 25,0 | 18,4 |
| k./ 15% R.O.I. | $/t | 14,0 | 12,5 | 9,3 |
| l./ Total /j+k/ | $/t | 41,6 | 37,5 | 27,7 |

| m./ Feedstock costs | | | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ |
|---|---|---|---|---|---|---|---|---|
| | 1. | $/t | 94,6 | 137,4 | 72,7 | 113,3 | 62,4 | 101,2 |
| | 2. | $/t | 111,3 | 155,0 | 90,5 | 131,9 | 74,7 | 116,3 |
| | 3. | $/t | 133,7 | 178,5 | 114,4 | 157,1 | 95,9 | 136,4 |
| | | $/t | | | | | | |

| n./ Product value /l+m/ at factory gate | | | | | |
|---|---|---|---|---|---|
| | 1. | $/t | 273,6 | 223,5 | 191,3 |
| | 2. | $/t | 307,9 | 259,9 | 218,7 |
| | 3. | $/t | 353,8 | 309,0 | 260,0 |
| | | $/t | | | |
| o./ Distribution cost | | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | | $/t | - | - | - |
| | | $/t | | | |
| | | $/t | | | |
| | | $/t | | | |

Product: Ammonia
Raw material: coal
Location: Developing site, Seaside

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 150 | 250 | 1000 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 50 | 83 | 275 |
| Total investment cost | M$ | 58,0 | 78,8 | 341,5 |
| Production cost | | | | |
| Materials Chemicals | $/t | 8,0 | 8,0 | 8,0 |
| a./ Total materials | $/t | 8,0 | 8,0 | 8,0 |
| Utilities | $/t | | | |
| Power | " | 33,0 | - | 3,0 |
| Steam | " | - | - | - |
| BFW/demineralized/ | " | 1,8 | 1,5 | 1,5 |
| Cooling water | " | 16,0 | 6,9 | 3,4 |
| b./ Total utilities | $/t | 50,8 | 8,4 | 7,9 |
| c./ Labour | $/t | 9,6 | 5,8 | 1,9 |
| d./ Overhead expenses | $/t | 24,0 | 14,5 | 4,8 |
| e./ Total/a+b+c+d/ | $/t | 92,4 | 36,7 | 22,6 |
| f./ Depreciation | $/t | 116 | 94,9 | 124,2 |
| g./ Maintenance | $/t | 46,4 | 38,0 | 49,7 |
| h./ Insurance and property taxes | $/t | 34,8 | 28,5 | 37,3 |
| i./ Total /f+g+h/ | $/t | 197,2 | 161,4 | 211,2 |
| j./ Total production cost / e+i/ | $/t | 289,6 | 198,1 | 233,8 |
| k./ 15% R.O.I. | $/t | 174,0 | 142,4 | 186,3 |
| l./ Total /j+k/ | $/t | 463,6 | 340,5 | 420,1 |
| m./ Feedstock costs | | | | |
| 4,6 $/10^6 kcal | 1. $/t | 55,2 | 58,9 | 47,4 |
| /coal/ 9,1 $ " | 2. $/t | 109,2 | 114,5 | 93,7 |
| 13,6 $ " | 3. $/t | 163,2 | 174,1 | 140,1 |
| | $/t | | | |
| n./ Product value /l+m/ at factory gate | 1. $/t | 518,8 | 399,4 | 467,5 |
| | 2. $/t | 572,8 | 455,0 | 513,8 |
| | 3. $/t | 626,8 | 514,6 | 560,2 |
| | $/t | | | |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |
| | $/t | | | |

Table 5-1.3o

Appendix 3/1

Product: Urea

Raw material: coal

Location: Developing site, Seaside

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 260 | 440 | 1700 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 86 | 145 | 468 |
| Total investment cost | M$ | 20,0 | 30,3 | 102,5 |
| Production cost | | | | |
| Materials | $/t | | | |
| a./ Total materials | $/t | - | - | - |
| Utilities | $/t | | | |
| Power | " | 4,5 | 4,2 | 3,9 |
| Steam | " | 13,8 | 13,5 | 12,6 |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 1,4 | 1,4 | 1,2 |
| Steam credit | | - | - | - 0,8 |
| b./ Total utilities | $/t | 19,7 | 19,1 | 16,9 |
| c./ Labour | $/t | 1,9 | 1,1 | 0,3 |
| d./ Overhead expenses | $/t | 4,8 | 2,8 | 0,8 |
| e./ Total/a+b+c+d/ | $/t | 26,4 | 23,0 | 18,0 |
| f./ Depreciation | $/t | 23,3 | 20,9 | 21,9 |
| g./ Maintenance | $/t | 9,3 | 8,4 | 8,8 |
| h./ Insurance and property taxes | $/t | 7,0 | 6,3 | 6,6 |
| i./ Total /f+g+h/ | $/t | 39,6 | 35,6 | 37,3 |
| j./ Total production cost / e+i/ | $/t | 66,0 | 58,6 | 55,3 |
| k./ 15% R.O.I. | $/t | 35,0 | 31,4 | 32,9 |
| l./ Total /j+k/ | $/t | 101,0 | 90,0 | 88,2 |
| m./ Feedstock costs /$NH_3$/ | 1. $/t | 295,7 | 227,7 | 266,5 |
| | 2. $/t | 326,5 | 259,4 | 292,9 |
| | 3. $/t | 357,3 | 293,3 | 319,3 |
| | $/t | | | |
| n./ Product value /l+m/ at factory gate | 1. $/t | 396,7 | 317,7 | 354,7 |
| | 2. $/t | 427,5 | 349,4 | 381,1 |
| | 3. $/t | 458,3 | 383,3 | 407,5 |
| | $/t | | | |
| o./ Distribution cost | $/t | 15,0 | 15,0 | 60,0 |
| p./ Farm-gate price /n+o/ | 1. $/t | 411,7 | 332,7 | 414,7 |
| | 2. $/t | 442,2 | 364,4 | 441,1 |
| | 3. $/t | 473,3 | 398,3 | 467,5 |
| | $/t | | | |

Product: Nitric acid

Raw material: coal

Location: Developing site, Seaside

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 273 | 455 | 1822 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 90 | 150 | 500 |
| Total investment cost | M$ | 18,0 | 30,0 | 139,5 |
| Production cost | | | | |
| Materials | $/t | | | |
| Platine | | 1,7 | 1,7 | 1,7 |
| a./ Total materials | $/t | 1,7 | 1,7 | 1,7 |
| Utilities | $/t | | | |
| Power | " | 0,4 | 0,4 | 0,4 |
| Steam | " | - | - | - |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 2,2 | 2,2 | 2,2 |
| BFW | | 0,1 | 0,1 | 0,1 |
| Steam credit | | - 6,0 | - 6,0 | - 6,0 |
| b./ Total utilities | $/t | - 3,3 | - 3,3 | - 3,3 |
| c./ Labour | $/t | 0,9 | 0,5 | 0,2 |
| d./ Overhead expenses | $/t | 2,3 | 1,3 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | 1,6 | 0,2 | - 0,9 |
| f./ Depreciation | $/t | 20,0 | 20,0 | 27,9 |
| g./ Maintenance | $/t | 8,0 | 8,0 | 11,2 |
| h./ Insurance and property taxes | $/t | 6,0 | 6,0 | 8,4 |
| i./ Total /f+g+h/ | $/t | 34,0 | 34,0 | 47,5 |
| j./ Total production cost / e+i/ | $/t | 35,6 | 34,2 | 46,6 |
| k./ 15% R.O.I. | $/t | 30,0 | 30,0 | 41,9 |
| l./ Total /j+k/ | $/t | 65,6 | 64,2 | 88,5 |
| m./ Feedstock costs | | | | |
| /$NH_3$/ 1. | $/t | 145,3 | 111,8 | 130,9 |
| 2. | $/t | 160,4 | 127,4 | 143,9 |
| 3. | $/t | 175,5 | 144,0 | 156,9 |
| | $/t | | | |
| n./ Product value /l+m/ at factory gate 1. | $/t | 210,9 | 176,0 | 219,4 |
| 2. | $/t | 226,0 | 191,6 | 232,4 |
| 3. | $/t | 241,1 | 208,2 | 245,4 |
| | $/t | | | |
| o./ Distribution cost | $/t | -- | - | - |
| p./ Farm-gate price /n+o/ | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |
| | $/t | | | |

Product: Ammonium nitrate
Raw material: coal
Location: Developing site, Seaside

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 355 | 591 | 2364 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 117 | 195 | 650 |
| Total investment cost | M$ | 13,9 | 20,5 | 71,8 |
| Production cost | | | | |
| Materials | $/t | | | |
| lime | | 0,8 | 0,8 | 0,8 |
| coating agent | | 0,6 | 0,6 | 0,6 |
| anti-caking agent | | 1,0 | 1,0 | 1,0 |
| MgO | | 0,8 | 0,8 | 0,3 |
| a./ Total materials | $/t | 3,2 | 3,2 | 3,2 |
| Utilities | $/t | | | |
| Power | " | 0,7 | 0,7 | 0,7 |
| Steam | " | 3,6 | 3,6 | 3,6 |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 0,8 | 0,8 | 0,8 |
| b./ Total utilities | $/t | 5,1 | 5,1 | 5,1 |
| c./ Labour | $/t | 1,1 | 0,7 | 0,2 |
| d./ Overhead expenses | $/t | 2,8 | 1,8 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | 12,2 | 10,8 | 9,0 |
| f./ Depreciation | $/t | 11,9 | 10,5 | 11,0 |
| g./ Maintenance | $/t | 4,8 | 4,2 | 4,4 |
| h./ Insurance and property taxes | $/t | 3,6 | 3,2 | 3,3 |
| i./ Total /f+g+h/ | $/t | 20,3 | 17,9 | 18,7 |
| j./ Total production cost / e+i/ | $/t | 32,5 | 28,7 | 27,7 |
| k./ 15% R.O.I. | $/t | 17,9 | 15,8 | 16,5 |
| l./ Total /j+k/ | $/t | 50,4 | 44,5 | 44,2 |

| m./ Feedstock costs | | | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ |
|---|---|---|---|---|---|---|---|---|
| | 1. | $/t | 106,4 | 162,0 | 81,9 | 135,2 | 95,8 | 168,5 |
| | 2. | $/t | 117,4 | 173,6 | 93,3 | 147,1 | 105,3 | 178,5 |
| | 3. | $/t | 128,5 | 185,2 | 105,5 | 160,0 | 114,8 | 188,5 |
| | | $/t | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| n./ Product value /l+m/ at factory gate | 1. | $/t | 318,8 | 261,6 | 308,5 |
| | 2. | $/t | 341,4 | 284,9 | 328,0 |
| | 3. | $/t | 364,1 | 310,0 | 347,5 |
| | | $/t | | | |
| o./ Distribution cost | | $/t | 15,0 | 15,0 | 60,0 |
| p./ Farm-gate price /n+o/ | | $/t | 333,8 | 276,6 | 368,5 |
| | | $/t | 356,4 | 299,9 | 388,0 |
| | | $/t | 379,1 | 325,0 | 407,5 |
| | | $/t | | | |

Product: Ammonia
Raw material: coal
Location: Developing site, Remote

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 150 | 250 | 1000 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 50 | 83 | 275 |
| Total investment cost | M$ | 68,0 | 92,0 | 444,0 |
| Production cost | | | | |
| Materials | $/t | | | |
| Chemicals | | 8,0 | 8,0 | 8,0 |
| a./ Total materials | $/t | 8,0 | 8,0 | 8,0 |
| Utilities | $/t | | | |
| Power | " | 33,0 | - | 3,0 |
| Steam | " | - | - | - |
| BFW/demineralized/ | " | 1,8 | 1,5 | 1,5 |
| Cooling water | " | 16,0 | 6,9 | 3,4 |
| b./ Total utilities | $/t | 50,8 | 8,4 | 7,9 |
| c./ Labour | $/t | 9,6 | 5,8 | 1,9 |
| d./ Overhead expenses | $/t | 24,0 | 14,5 | 4,8 |
| e./ Total/a+b+c+d/ | $/t | 92,4 | 36,7 | 22,6 |
| f./ Depreciation | $/t | 136,0 | 110,8 | 161,5 |
| g./ Maintenance | $/t | 54,4 | 44,3 | 64,6 |
| h./ Insurance and property taxes | $/t | 40,8 | 33,2 | 48,5 |
| i./ Total /f+g+h/ | $/t | 231,2 | 188,3 | 274,6 |
| j./ Total production cost / e+i/ | $/t | 323,6 | 225,0 | 297,2 |
| k./ 15% R.O.I. | $/t | 204,0 | 166,2 | 242,3 |
| l./ Total /j+k/ | $/t | 527,6 | 391,2 | 539,5 |
| m./ Feedstock costs | | | | |
| 4,6 $/10$^6$kcal | 1. $/t | 55,2 | 58,9 | 47,4 |
| /coal/ 9,1 $ " | 2. $/t | 109,2 | 116,5 | 93,7 |
| 13,6 $ " | 3. $/t | 163,2 | 174,1 | 140,1 |
| | $/t | | | |
| n./ Product value /l+m/ at factory gate | 1. $/t | 582,8 | 450,1 | 586,9 |
| | 2. $/t | 636,8 | 507,7 | 633,2 |
| | 3. $/t | 690,8 | 565,3 | 679,6 |
| | $/t | | | |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | | | |
| | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |

Product: Urea
Raw material: coal
Location: Developing site, Remote

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 260 | 440 | 1700 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 86 | 145 | 468 |
| Total investment cost | M$ | 23,4 | 35,5 | 133,2 |
| Production cost | | | | |
| Materials | $/t | | | |
| a./ Total materials | $/t | - | - | - |
| Utilities | $/t | | | |
| Power | " | 4,5 | 4,2 | 3,9 |
| Steam | " | 13,8 | 13,5 | 12,6 |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 1,4 | 1,4 | 1,2 |
| Steam credit | " | - | - | - 0,8 |
| b./ Total utilities | $/t | 19,7 | 19,1 | 16,9 |
| c./ Labour | $/t | 1,9 | 1,1 | 0,3 |
| d./ Overhead expenses | $/t | 4,8 | 2,8 | 0,8 |
| e./ Total/a+b+c+d/ | $/t | 26,4 | 23,0 | 18,0 |
| f./ Depreciation | $/t | 27,2 | 24,5 | 28,5 |
| g./ Maintenance | $/t | 10,9 | 9,8 | 11,4 |
| h./ Insurance and property taxes | $/t | 8,2 | 7,4 | 8,6 |
| i./ Total /f+g+h/ | $/t | 46,3 | 41,7 | 48,5 |
| j./ Total production cost / e+i/ | $/t | 72,7 | 64,7 | 66,5 |
| k./ 15% R.O.I. | $/t | 40,8 | 36,8 | 42,8 |
| l./ Total /j+k/ | $/t | 113,5 | 101,5 | 109,3 |
| m./ Feedstock costs /$NH_3$/ | 1. $/t | 332,2 | 256,6 | 334,5 |
| | 2. $/t | 363,0 | 289,4 | 360,9 |
| | 3. $/t | 393,8 | 322,2 | 387,4 |
| | $/t | | | |
| n./ Product value /l+m/ at factory gate | 1. $/t | 445,7 | 358,1 | 443,8 |
| | 2. $/t | 476,5 | 390,9 | 470,2 |
| | 3. $/t | 507,3 | 423,7 | 496,7 |
| | $/t | | | |
| o./ Distribution cost | $/t | 15,0 | 15,0 | 60,0 |
| p./ Farm-gate price /n+o/ | 1. $/t | 460,7 | 373,1 | 503,8 |
| | 2. $/t | 491,5 | 405,9 | 530,2 |
| | 3. $/t | 522,3 | 438,7 | 556,7 |
| | $/t | | | |

Product: Nitric acid
Raw material: coal
Location: Developing site, Remote

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 273 | 455 | 1822 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 90 | 150 | 500 |
| Total investment cost | M$ | 21,3 | 35,1 | 181,2 |
| Production cost | | | | |
| Materials | $/t | | | |
| Platins | | 1,7 | 1,7 | 1,7 |
| a./ Total materials | $/t | 1,7 | 1,7 | 1,7 |
| Utilities | $/t | | | |
| Power | " | 0,4 | 0,4 | 0,4 |
| Steam | " | - | - | - |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 2,2 | 2,2 | 2,2 |
| BFW | " | 0,1 | 0,1 | 0,1 |
| Steam credit | " | - 6,0 | - 6,0 | - 6,0 |
| b./ Total utilities | $/t | - 3,3 | - 3,3 | - 3,3 |
| c./ Labour | $/t | 0,9 | 0,5 | 0,2 |
| d./ Overhead expenses | $/t | 2,3 | 1,3 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | 1,6 | 0,2 | - 0,9 |
| f./ Depreciation | $/t | 23,7 | 23,4 | 36,2 |
| g./ Maintenance | $/t | 9,5 | 9,4 | 14,5 |
| h./ Insurance and property taxes | $/t | 7,1 | 7,0 | 10,9 |
| i./ Total /f+g+h/ | $/t | 40,3 | 39,8 | 61,6 |
| j./ Total production cost / e+i/ | $/t | 41,9 | 40,0 | 60,7 |
| k./ 15% R.O.I. | $/t | 35,6 | 35,1 | 54,3 |
| l./ Total /j+k/ | $/t | 77,5 | 75,1 | 115,0 |
| m./ Feedstock costs | | | | |
| /$NH_3$/ | 1. $/t | 163,2 | 126,0 | 164,3 |
| | 2. $/t | 178,3 | 142,2 | 177,3 |
| | 3. $/t | 193,4 | 158,3 | 190,3 |
| | $/t | | | |
| n./ Product value /l+m/ st factory gate | 1. $/t | 240,7 | 201,1 | 279,3 |
| | 2. $/t | 255,8 | 217,3 | 292,3 |
| | 3. $/t | 270,9 | 233,4 | 305,3 |
| | $/t | | | |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |
| | $/t | | | |

Product: Ammonium nitrate

Raw material: coal

Location: Developing site, Remote

| | | | | |
|---|---|---|---|---|
| Capacity | t/d | 355 | 591 | 2364 |
| On-stream factor | % | 90 | 90 | 75 |
| Production | kt/y | 117 | 195 | 650 |
| Total investment cost | M$ | 16,2 | 24,1 | 93,2 |
| Production cost | | | | |
| Materials | $/t | | | |
| lime | | 0,8 | 0,8 | 0,8 |
| cooling agent | | 0,6 | 0,6 | 0,6 |
| anti-caking agent | | 1,0 | 1,0 | 1,0 |
| MgO | | 0,8 | 0,8 | 0,8 |
| a./ Total materials | $/t | 3,2 | 3,2 | 3,2 |
| Utilities | $/t | | | |
| Power | " | 0,7 | 0,7 | 0,7 |
| Steam | " | 3,6 | 3,6 | 3,6 |
| BFW/demineralized/ | " | - | - | - |
| Cooling water | " | 0,8 | 0,8 | 0,8 |
| b./ Total utilities | $/t | 5,1 | 5,1 | 5,1 |
| c./ Labour | $/t | 1,1 | 0,7 | 0,2 |
| d./ Overhead expenses | $/t | 2,8 | 1,8 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | 12,2 | 10,8 | 9,0 |
| f./ Depreciation | $/t | 13,8 | 12,4 | 14,3 |
| g./ Maintenance | $/t | 5,5 | 5,0 | 5,7 |
| h./ Insurance and property taxes | $/t | 4,1 | 3,7 | 4,3 |
| i./ Total /f+g+h/ | $/t | 23,4 | 21,1 | 24,3 |
| j./ Total production cost / e+i/ | $/t | 35,6 | 31,9 | 33,3 |
| k./ 15% R.O.I. | $/t | 20,7 | 18,6 | 21,5 |
| l./ Total /j+k/ | $/t | 56,3 | 50,5 | 54,8 |

| m./ Feedstock costs | | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ | $NH_3$ | $HNO_3$ |
|---|---|---|---|---|---|---|---|
| 1. | $/t | 119,5 | 184,9 | 92,3 | 154,4 | 120,3 | 214,5 |
| 2. | $/t | 130,5 | 296,5 | 104,1 | 166,9 | 129,8 | 224,5 |
| 3. | $/t | 141,6 | 208,1 | 115,9 | 179,3 | 139,3 | 234,5 |
| | $/t | | | | | | |

| n./ Product value /l+m/ at factory gate | | | | |
|---|---|---|---|---|
| 1. | $/t | 360,7 | 297,2 | 389,6 |
| 2. | $/t | 383,3 | 321,5 | 409,1 |
| 3. | $/t | 406,0 | 345,7 | 428,6 |
| | $/t | | | |
| o./ Distribution cost | $/t | 15,0 | 15,0 | 60,0 |
| p./ Farm-gate price /n+o/ 1. | $/t | 375,7 | 312,2 | 449,6 |
| 2. | $/t | 398,3 | 336,5 | 469,1 |
| 3. | $/t | 421,0 | 360,7 | 488,6 |
| | $/t | | | |

Table 5-2.1

Product: Sulphuric acid

Raw material: sulphur

Location: Developed site, West-Europe

| | | | |
|---|---|---|---|
| Capacity | t/d | 200 | 600 |
| On-stream factor | % | 90 | 90 |
| Production | kt/y | 66 | 200 |
| Total investment cost | M$ | 9,7 | 22,5 |
| Production cost | | | |
| Materials | $/t | | |
| a./ Total materials | $/t | - | |
| Utilities | $/t | 1,5 | 1,5 |
| Power | " | - 18,0 | -18,0 |
| Steam | " | | |
| BFW/demineralized/ | " | | |
| Cooling water | " | 0,7 | 0,7 |
| b./ Total utilities | $/t | -15,8 | -15,8 |
| c./ Labour | $/t | 3,6 | 1,5 |
| d./ Overhead expenses | $/t | 5,4 | 2,3 |
| e./ Total/a+b+c+d/ | $/t | - 6,8 | - 12,0 |
| f./ Depreciation | $/t | 14,7 | 11,3 |
| g./ Maintenance | $/t | 4,4 | 3,4 |
| h./ Insurance and property taxes | $/t | 3,0 | 2,2 |
| i./ Total /f+g+h/ | $/t | 22,1 | 16,9 |
| j./ Total production cost / e+i/ | $/t | 15,3 | 4,9 |
| k./ 15% R.O.I. | $/t | 22,1 | 16,9 |
| l./ Total /j+k/ | $/t | 37,4 | 21,8 |
| m./ Feedstock costs sulphur 90 $/t | $/t<br>$/t<br>$/t<br>$/t | 29,7 | 29,7 |
| n./ Product value /l+m/ at factory gate | $/t<br>$/t<br>$/t<br>$/t | 67,1 | 51,5 |
| o./ Distribution cost | $/t | - | - |
| p./ Farm-gate price /n+o/ | $/t<br>$/t<br>$/t<br>$/t | - | - |

Product: Sulphuric acid

Raw material: sulphur

Location: Developing site, Seaside

| | | | |
|---|---|---|---|
| Capacity | t/d | 200 | 600 |
| On-stream factor | % | 90 | 90 |
| Production | kt/y | 66 | 200 |
| Total investment cost | M$ | 12,3 | 28,6 |
| Production cost | | | |
| Materials | $/t | | |
| a./ Total materials | $/t | | |
| Utilities | $/t | | |
| Power | " | 1,5 | 1,5 |
| Steam | " | -18,0 | -18,0 |
| BFW/demineralized/ | " | | |
| Cooling water | " | 0,7 | 0,7 |
| b./ Total utilities | $/t | -15,8 | -15,8 |
| c./ Labour | $/t | 0,2 | 0,2 |
| d./ Overhead expenses | $/t | 0,5 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | -15,1 | -15,1 |
| f./ Depreciation | $/t | 9,5 | 14,3 |
| g./ Maintenance | $/t | 7,5 | 5,7 |
| h./ Insurance and property taxes | $/t | 5,6 | 4,3 |
| i./ Total /f+g+h/ | $/t | 22,6 | 24,3 |
| j./ Total production cost / e+i/ | $/t | 7,5 | 9,2 |
| k./ 15% R.O.I. | $/t | 28,0 | 21,5 |
| l./ Total /j+k/ | $/t | 35,5 | 30,7 |
| m./ Feedstock costs sulphur 100 $/t | $/t<br>$/t<br>$/t<br>$/t | 33,0 | 33,0 |
| n./ Product value /l+m/ at factory gate | $/t<br>$/t<br>$/t<br>$/t | 68,5 | 63,7 |
| o./ Distribution cost | $/t | - | - |
| p./ Farm-gate price /n+o/ | $/t<br>$/t<br>$/t<br>$/t | - | - |

Product: Sulphuric acid

Raw material: sulphur

Location: Developing site, Remote

| | | | |
|---|---|---|---|
| Capacity | t/d | 200 | 600 |
| On-stream factor | % | 90 | 90 |
| Production | kt/y | 66 | 200 |
| Total investment cost | M$ | 14,4 | 33,5 |
| Production cost | | | |
| Materials | $/t | | |
| a./ Total materials | $/t | - | - |
| Utilities | $/t | | |
| Power | " | 1,5 | 1,5 |
| Steam | " | -18,0 | -18,0 |
| BFW/demineralized/ | " | | |
| Cooling water | " | 0,7 | 0,7 |
| b./ Total utilities | $/t | -15,8 | -15,8 |
| c./ Labour | $/t | 0,2 | 0,2 |
| d./ Overhead expenses | $/t | 0,5 | 0,5 |
| e./ Total/a+b+c+d/ | $/t | -15,1 | -15,1 |
| f./ Depreciation | $/t | 21,8 | 16,8 |
| g./ Maintenance | $/t | 8,7 | 6,7 |
| h./ Insurance and property taxes | $/t | 6,5 | 5,0 |
| i./ Total /f+g+h/ | $/t | 37,0 | 28,5 |
| j./ Total production cost / e+i/ | $/t | 21,9 | 13,4 |
| k./ 15% R.O.I. | $/t | 32,7 | 25,1 |
| l./ Total /j+k/ | $/t | 54,6 | 38,5 |
| m./ Feedstock costs sulphur 100$/t | $/t<br>$/t<br>$/t<br>$/t | 33,0 | 33,0 |
| n./ Product value /l+m/ at factory gate | $/t<br>$/t<br>$/t<br>$/t<br>$/t | 87,6 | 71,5 |
| o./ Distribution cost | $/t | - | - |
| p./ Farm-gate price /n+o/ | $/t<br>$/t<br>$/t<br>$/t | - | - |

Appendix 3/1

Table 5-2.4

Product: Phosphoric acid

Raw material: phosphate rock

| Location: | | Developed site West-Europe | Developing site Seaside | Developing site Remote |
|---|---|---|---|---|
| Capacity | t/d | 200 /$P_2O_5$/ | 370 /tel-quel/ | |
| On-stream factor | % | 90 | | |
| Production | kt/y | 66 /$P_2O_5$/ | 122,1 /tel-quel/ | |
| Total investment cost | M$ | 23,8 | 30,3 | 35,5 |
| Production cost | | | | |
| Materials | $/t | | | |
| sulphuric acid | | 151,9 | 187,9 | 210,9 |
| a./ Total materials | $/t | 151,9 | 187,9 | 210,9 |
| Utilities | $/t | | | |
| Power | " | 3,5 | 3,5 | 3,5 |
| Steam | " | 36,1 | 36,1 | 36,1 |
| BFW/demineralized/ | " | | | |
| Cooling water | " | | | |
| Process water | " | 0,1 | 0,1 | 0,1 |
| b./ Total utilities | $/t | 39,7 | 39,7 | 39,7 |
| c./ Labour | $/t | 7,3 | 3,9 | 3,9 |
| d./ Overhead expenses | $/t | 11,0 | 9,8 | 9,8 |
| e./ Total/a+b+c+d/ | $/t | 209,9 | 241,3 | 264,3 |
| f./ Depreciation | $/t | 36,1 | 45,9 | 53,8 |
| g./ Maintenance | $/t | 10,8 | 18,3 | 21,5 |
| h./ Insurance and property taxes | $/t | 7,2 | 13,8 | 16,2 |
| i./ Total /f+g+h/ | $/t | 54,1 | 78,0 | 91,5 |
| j./ Total production cost / e+i/ | $/t | 264,0 | 319,3 | 355,8 |
| k./ 15% R.O.I. | $/t | 54,1 | 68,9 | 80,7 |
| l./ Total /j+k/ | $/t | 318,1 | 388,2 | 436,5 |
| m./ Feedstock costs phosphate rock 1.15$/t | $/t | - | 49,2 | 49,2 |
| 2.30$/t | $/t | - | 98,4 | 98,4 |
| 3.50$/t | $/t | 164,0 | 164,0 | 164,0 |
| 4.70$/t | $/t | 229,6 | | |
| n./ Product value /l+m/ at factory gate 1. | $/t | - | 437,4 | 485,7 |
| 2. | $/t | - | 486,6 | 534,9 |
| 3. | $/t | 482,1 | 552,2 | 600,5 |
| 4. | $/t | 547,1 | - | - |
| o./ Distribution cost | $/t | - | - | - |
| p./ Farm-gate price /n+o/ | $/t | - | - | - |
| | $/t | | | |
| | $/t | | | |
| | $/t | | | |

| Product / Raw material | SSP /18% $P_2O_5$/ phosphate rock | | | |
|---|---|---|---|---|
| Location | | | Developed site /West-Europe/ | Developing site Seaside | Developing site Remote |
| Capacity | | t/d | 500 | 500 | 500 |
| On-stream factor | | % | 90 | | |
| Production | | kt/y | 160 | | |
| Total investment cost | | M$ | 4,4 | 5,7 | 6,6 |
| Production cost | | | | | |
| Materials | | $/t | 24,2 | 24,7 | 31,5 |
| a./ Total materials | | $/t | 24,2 | 24,7 | 31,5 |
| Utilities | | $/t | 0,2 | 0,2 | 0,2 |
| Power | | " | | | |
| Steam | | " | | | |
| BFW/demineralized/ | | " | | | |
| Cooling water | | " | | | |
| b./ Total utilities | | $/t | 0,2 | 0,2 | 0,2 |
| c./ Labour | | $/t | 1,8 | 1,0 | 1,0 |
| d./ Overhead expenses | | $/t | 2,7 | 2,5 | 2,5 |
| e./ Total/a+b+c+d/ | | $/t | 28,9 | 28,4 | 35,2 |
| f./ Depreciation | | $/t | 2,8 | 3,6 | 4,1 |
| g./ Maintenance | | $/t | 0,8 | 1,4 | 1,7 |
| h./ Insurance and property taxes | | $/t | 0,5 | 1,1 | 1,2 |
| i./ Total /f+g+h/ | | $/t | 4,1 | 6,1 | 7,0 |
| j./ Total production cost / e+i/ | | $/t | 33,0 | 34,5 | 42,2 |
| k./ 15% R.O.I. | | $/t | 4,1 | 5,3 | 6,2 |
| l./ Total /j+k/ | | $/t | 37,1 | 39,8 | 48,4 |
| m./ Feedstock costs phosphate rock | 1. 15$/t | $/t | - | 8,7 | 8,7 |
| | 2. 30$/t | $/t | - | 17,4 | 17,4 |
| | 3. 50$/t | $/t | 29,0 | 29,0 | 29,0 |
| | 4. 70$/t | $/t | 40,6 | - | - |
| n./ Product value /l+m/ at factory gate | 1. | $/t | - | 48,5 | 57,1 |
| | 2. | $/t | - | 57,2 | 65,8 |
| | 3. | $/t | 66,1 | 68,8 | 77,4 |
| | 4. | $/t | 77,7 | - | - |
| o./ Distribution cost | | $/t | - | 15,0 | 15,0 |
| p./ Farm-gate price /n+o/ | | $/t | - | 63,5 | 72,1 |
| | | $/t | - | 72,2 | 80,8 |
| | | $/t | - | 83,8 | 92,4 |
| | | $/t | - | - | - |

Appendix 3/1 Table 5-2.6

Product: TSP /46% $P_2O_5$/
Raw material: phosphate rock

| | | Developed site /West-Europe/ | Developing site Seaside | Developing site Remote |
|---|---|---|---|---|
| Location | | | | |
| Capacity | t/d | 500 | 500 | 500 |
| On-stream factor | % | 90 | | |
| Production | kt/y | 160 | | |
| Total investment cost | M$ | 5,1 | 6,5 | 7,6 |
| Production cost | | | | |
| Materials | $/t | | | |
| a./ Total materials | $/t | | | |
| Utilities | $/t | | | |
| Power | " | | | |
| Steam | " | 0,2 | 0,2 | 0,2 |
| BFW/demineralized/ | " | | | |
| Cooling water | " | | | |
| b./ Total utilities | $/t | 0,2 | 0,2 | 0,2 |
| c./ Labour | $/t | 1,9 | 1,0 | 1,0 |
| d./ Overhead expenses | $/t | 2,9 | 2,5 | 2,5 |
| e./ Total/a+b+c+d/ | $/t | 5,0 | 3,7 | 3,7 |
| f./ Depreciation | $/t | 3,2 | 4,1 | 4,8 |
| g./ Maintenance | $/t | 1,0 | 1,6 | 1,9 |
| h./ Insurance and property taxes | $/t | 0,6 | 1,2 | 1,4 |
| i./ Total /f+g+h/ | $/t | 4,8 | 6,9 | 8,1 |
| j./ Total production cost / e+i/ | $/t | 9,8 | 10,6 | 11,8 |
| k./ 15% R.O.I. | $/t | 4,8 | 6,1 | 7,1 |
| l./ Total /j+k/ | $/t | 16,4 | 16,7 | 18,9 |

| m./ Feedstock costs | | | Phosph.rock | $H_3PO_4$ | Phosph.rock | $H_3PO_4$ | Phosph.rock | $H_3PO_4$ |
|---|---|---|---|---|---|---|---|---|
| phosphate rock | 1. 15$/t | $/t | - | - | 6,2 | 148,7 | 6,2 | 165,1 |
| | 2. 30$/t | $/t | - | - | 12,3 | 165,4 | 12,3 | 181,9 |
| | 3. 50$/t | $/t | 20,5 | 163,9 | 20,5 | 187,7 | 20,5 | 204,2 |
| | 4. 70$/t | $/t | 28,7 | 186,2 | - | - | - | - |
| n./ Product value /l+m/ at factory gate | 1. | $/t | | - | | 171,6 | | 190,2 |
| | 2. | $/t | | - | | 194,4 | | 213,1 |
| | 3. | $/t | | 200,8 | | 224,9 | | 243,6 |
| | 4. | $/t | | 231,3 | | - | | - |
| o./ Distribution cost | | $/t | | - | | 15,0 | | 15,0 |
| p./ Farm-gate price /n+o/ | 1. | $/t | | - | | 186,6 | | 205,2 |
| | 2. | $/t | | | | 209,4 | | 228,1 |
| | 3. | $/t | | | | 239,9 | | 258,6 |
| | 4. | $/t | | | | - | | - |

Product: MAP /12% N + 52% $P_2O_5$

Raw material:

Location: Developed site, West-Europe

| | | |
|---|---|---|
| Capacity | t/d | 375 |
| On-stream factor | % | 90 |
| Production | kt/y | 120 |
| Total investment cost | M$ | 8,1 |
| Production cost | | |
| Materials | $/t | |
| a./ Total materials | $/t | |
| Utilities | $/t | |
| Power | " | 0,9 |
| Steam | " | 0,4 |
| BFW/demineralized/ | " | |
| Cooling water | " | |
| Fuel | | 3,0 |
| b./ Total utilities | $/t | 4,3 |
| c./ Labour | $/t | 2,5 |
| d./ Overhead expenses | $/t | 3,8 |
| e./ Total/a+b+c+d/ | $/t | 10,6 |
| f./ Depreciation | $/t | 6,8 |
| g./ Maintenance | $/t | 2,0 |
| h./ Insurance and property taxes | $/t | 1,4 |
| i./ Total /f+g+h/ | $/t | 10,2 |
| j./ Total production cost / e+i/ | $/t | 20,8 |
| k./ 15% R.O.I. | $/t | 10,2 |
| l./ Total /j+k/ | $/t | 31,0 |
| m./ Feedstock costs | $/t | |
| ammonia 1/ | $/t | 31,4 |
| phosphoric acid 1/ | $/t | 255,5 |
| | $/t | |
| | $/t | |
| n./ Product value /l+m/ at factory gate | $/t | 317,9 |
| | $/t | |
| | $/t | |
| | $/t | |
| o./ Distribution cost | $/t | - |
| p./ Farm-gate price /n+o/ | $/t | - |
| | $/t | |
| | $/t | |
| | $/t | |

1/ With the lowest ammonia cost and the lowest price of phosphate rock

Table 5-2.8

Appendix 3/1

Product: DAP /18% N + 46% $P_2O_5$/

Raw material:

Location: Developed site, West-Europe

| | | |
|---|---|---|
| Capacity | t/d | 425 |
| On-stream factor | % | 90 |
| Production | kt/y | 130 |
| Total investment cost | M$ | 8,1 |
| Production cost | | |
| Materials | $/t | - |
| a./ Total materials | $/t | - |
| Utilities | $/t | |
| Power | " | 0.9 |
| Steam | " | 0,3 |
| BFW/demineralized/ | " | - |
| Cooling water | " | |
| Fuel | | 1,5 |
| b./ Total utilities | $/t | 2,7 |
| c./ Labour | $/t | 2,3 |
| d./ Overhead expenses | $/t | 3,5 |
| e./ Total/a+b+c+d/ | $/t | 8,5 |
| f./ Depreciation | $/t | 6,2 |
| g./ Maintenance | $/t | 1,9 |
| h./ Insurance and property taxes | $/t | 1,2 |
| i./ Total /f+g+h/ | $/t | 9,3 |
| j./ Total production cost / e+i/ | $/t | 17,8 |
| k./ 15% R.O.I. | $/t | 9,3 |
| l./ Total /j+k/ | $/t | 27,1 |
| m./ Feedstock costs | | |
| ammonia | $/t | 47,3 |
| sulphuric acid | $/t | 2,1 |
| phosphoric acid | $/t | 226,1 |
| | $/t | |
| n./ Product value /l+m/ at factory gate | $/t | 302,6 |
| | $/t | |
| | $/t | |
| | $/t | |
| o./ Distribution cost | $/t | - |
| p./ Farm-gate price /n+o/ | $/t | - |
| | $/t | |
| | $/t | |
| | $/t | |

Product: NPK /19:19:19/

Raw material:

Location: Developed site, West-Europe

| | | |
|---|---|---|
| Capacity | t/d | 1040 |
| On-stream factor | % | 90 |
| Production | kt/y | 320 |
| Total investment cost | M$ | 12,5 |
| Production cost | | |
| Materials | $/t | - |
| a./ Total materials | $/t | - |
| Utilities | $/t | |
| Power | " | 1,4 |
| Steam | " | 1,5 |
| BFW/demineralized/ | " | - |
| Cooling water | " | - |
| Fuel | | 2,0 |
| b./ Total utilities | $/t | 4,9 |
| c./ Labour | $/t | 1,1 |
| d./ Overhead expenses | $/t | 1,7 |
| e./ Total/a+b+c+d/ | $/t | 7,7 |
| f./ Depreciation | $/t | 3,9 |
| g./ Maintenance | $/t | 1,2 |
| h./ Insurance and property taxes | $/t | 0,8 |
| i./ Total /f+g+h/ | $/t | 5,9 |
| j./ Total production cost / e+i/ | $/t | 13,6 |
| k./ 15% R.O.I. | $/t | 5,9 |
| l./ Total /j+k/ | $/t | 19,5 |
| m./ Feedstock costs | | |
| phosphoric acid | $/t | 92,6 |
| urea | $/t | 41,7 |
| ammonia | $/t | 17,5 |
| potash | $/t | 22,4 |
| n./ Product value /l+m/ at factory gate | $/t | 193,7 |
| o./ Distribution cost | $/t | - |
| p./ Farm-gate price /n+o/ | $/t | - |

## Product value at factory gate

$/t

| Raw material natural gas $/Gcal | Ammonia Capacity 150 t/d | 250 t/d | 1000 t/d | Urea Capacity 260 t/d | 440 t/d | 1700 t/d | Ammonium nitrate Capacity 355 t/d | 591 t/d | 2364 t/d |
|---|---|---|---|---|---|---|---|---|---|
| **West-Europe** | | | | | | | | | |
| 1./ - | - | - | - | - | - | - | - | - | - |
| 2./ 3,5 | 270 | 200 | 174 | 237 | 187 | 155 | 193 | 158 | 137 |
| 3./ 5,9 | 288 | 220 | 191 | 248 | 199 | 164 | 200 | 167 | 144 |
| 4./ 11,8 | 332 | 269 | 234 | 273 | 227 | 189 | 219 | 188 | 162 |
| 5./ 17,6 | 376 | 318 | 276 | 298 | 255 | 212 | 238 | 208 | 179 |
| **Seaside location** | | | | | | | | | |
| 1./ 1,8 | 314 | 232 | 278 | 280 | 222 | 247 | 233 | 191 | 229 |
| 2./ 3,5 | 327 | 246 | 290 | 287 | 230 | 254 | 238 | 197 | 234 |
| 3./ 5,9 | 345 | 266 | 307 | 297 | 242 | 264 | 246 | 206 | 242 |
| 4./ 11,8 | 389 | 316 | 350 | 323 | 270 | 288 | 264 | 227 | 260 |
| 5./ - | - | - | - | - | - | - | - | - | - |
| **Remote location** | | | | | | | | | |
| 1./ 1,8 | 352 | 264 | 352 | 314 | 252 | 310 | 264 | 219 | 292 |
| 2./ 3,5 | 365 | 279 | 365 | 322 | 260 | 317 | 269 | 225 | 297 |
| 3./ 5,9 | 383 | 299 | 382 | 332 | 272 | 327 | 277 | 234 | 304 |
| 4./ 11,8 | 427 | 348 | 424 | 357 | 300 | 351 | 295 | 255 | 322 |
| 5./ - | - | - | - | - | - | - | - | - | - |

## Value of 1 t N at factory gate

| Raw material: natural gas | Urea capacity 260 t/d | Urea capacity 440 t/d | Urea capacity 1700 t/d | Ammonium nitrate capacity 355 t/d | Ammonium nitrate capacity 591 t/d | Ammonium nitrate capacity 2364 t/d |
|---|---|---|---|---|---|---|
| **Seaside location** | | | | | | |
| 1./ 1,8 $/Gcal | 609 | 483 | 537 | 685 | 562 | 674 |
| 2./ 3,5 " | 624 | 500 | 552 | 700 | 579 | 688 |
| 3./ 5,9 " | 646 | 526 | 574 | 724 | 606 | 712 |
| 4./ 11,8 " | 702 | 587 | 626 | 776 | 668 | 765 |
| **Remote location** | | | | | | |
| 1./ 1,8 $/Gcal | 683 | 548 | 674 | 776 | 644 | 859 |
| 2./ 3,5 " | 700 | 565 | 689 | 791 | 662 | 874 |
| 3./ 5,9 " | 722 | 591 | 711 | 815 | 688 | 894 |
| 4./ 11,8 " | 776 | 652 | 763 | 868 | 750 | 947 |

## Product value at factory gate

$/t

| Raw material fuel oil $/Gcal | | Ammonia Capacity 150 t/d | 250 t/d | 1000 t/d | Urea Capacity 260 t/d | 440 t/d | 1700 t/d | Ammonium nitrate Capacity 355 t/d | 591 t/d | 2364 t/d |
|---|---|---|---|---|---|---|---|---|---|---|
| **West-Europe** | | | | | | | | | | |
| 1./ | 12 | - | - | - | - | - | - | - | - | - |
| 2./ | 15 | 392 | 327 | 295 | 307 | 260 | 223 | 245 | 212 | 187 |
| 3./ | 18 | 415 | 353 | 319 | 320 | 275 | 237 | 254 | 223 | 198 |
| **Seaside location** | | | | | | | | | | |
| 1./ | 12 | 432 | 353 | 404 | 347 | 291 | 319 | 282 | 242 | 282 |
| 2./ | 15 | 455 | 380 | 429 | 360 | 306 | 333 | 292 | 253 | 292 |
| 3./ | 18 | - | - | - | - | - | - | - | - | - |
| **Remote location** | | | | | | | | | | |
| 1./ | 12 | 477 | 392 | 490 | 385 | 325 | 389 | 316 | 273 | 349 |
| 2./ | 15 | 500 | 418 | 515 | 398 | 340 | 403 | 326 | 284 | 360 |
| 3./ | 18 | - | - | - | - | - | - | - | - | - |

## Product value at factory gate

$/t

| Raw material coal $/Gcal | | Ammonia Capacity 150 t/d | 250 t/d | 1000 t/d | Urea Capacity 260 t/d | 440 t/d | 1700 t/d | Ammonium nitrate Capacity 355 t/d | 591 t/d | 2364 t/d |
|---|---|---|---|---|---|---|---|---|---|---|
| **West-Europe** | | | | | | | | | | |
| 1./ | 4,6 | - | - | - | - | - | - | - | - | - |
| 2./ | 6,8 | 461 | 355 | 304 | 347 | 276 | 229 | 274 | 224 | 191 |
| 3./ | 9,1 | - | - | - | - | - | - | - | - | - |
| 4./ | 13,6 | 543 | 440 | 374 | 393 | 325 | 269 | 308 | 260 | 219 |
| 5./ | 22,7 | 652 | 558 | 468 | 455 | 392 | 322 | 354 | 309 | 260 |
| **Seaside location** | | | | | | | | | | |
| 1./ | 4,6 | 519 | 400 | 468 | 397 | 318 | 355 | 319 | 262 | 309 |
| 2./ | 6,8 | - | - | - | - | - | - | - | - | - |
| 3./ | 9,1 | 573 | 455 | 514 | 428 | 349 | 382 | 341 | 285 | 328 |
| 4./ | 13,6 | 627 | 515 | 560 | 458 | 383 | 408 | 364 | 310 | 348 |
| 5./ | 22,7 | - | - | - | - | - | - | - | - | - |
| **Remote location** | | | | | | | | | | |
| 1./ | 4,6 | 583 | 450 | 587 | 446 | 358 | 444 | 361 | 297 | 360 |
| 2./ | 6,8 | - | - | - | - | - | - | - | - | - |
| 3./ | 9,1 | 637 | 508 | 633 | 476 | 391 | 470 | 383 | 322 | 409 |
| 4./ | 13,6 | 691 | 565 | 680 | 507 | 424 | 496 | 406 | 346 | 429 |
| 5./ | 22,7 | - | - | - | - | - | - | - | - | - |

Appendix 3/1

Table 6-2

## Product value at factory gate

| | | | Developed site | | Developing site | | | |
|---|---|---|---|---|---|---|---|---|
| | | | West - Europe | | Seaside location | | Remote | |
| | | | $/t | | $/t | | $/t | |
| Sulphuric acid 200 t/d | | | | | | | | |
| sulphur | | 90 $/t | 67,1 | | - | | - | |
| | | 100 $/t | - | | 68,5 | | 87,6 | |
| 600 t/d | | | | | | | | |
| sulphur | | 90 $/t | 51,5 | | - | | - | |
| | | 100 $/t | - | | 63,7 | | 71,5 | |
| Phosphoric acid 200 t/d /$P_2O_5$/ | | | t/100%/ $P_2O_5$ | t/54%/ $P_2O_5$ | t/100%/ $P_2O_5$ | t/54%/ $P_2O_5$ | t/100%/ $P_2O_5$ | t/54%/ $P_2O_5$ |
| phosphate rock | 1./ | 15 $/t | - | - | 437,4 | 236,2 | 435,7 | 262,3 |
| | 2./ | 30 $/t | - | - | 486,6 | 262,8 | 534,9 | 288,8 |
| | 3./ | 50 $/t | 482,1 | 260,3 | 552,2 | 298,2 | 600,5 | 324,3 |
| | 4./ | 70 $/t | 547,7 | 295,8 | - | - | - | - |
| SSP 500 t/d /18% $P_2O_5$/ | | | | | | | | |
| phosphate rock | 1./ | 15 $/t | - | - | 48,5 | | 57,1 | |
| | 2./ | 30 $/t | - | - | 57,2 | | 65,8 | |
| | 3./ | 50 $/t | 66,1 | | 68,8 | | 77,4 | |
| | 4./ | 70 $/t | 77,7 | | - | | - | |
| TSP 500 t/d /46% $P_2O_5$/ | | | | | | | | |
| phosphate rock | 1./ | 15 $/t | - | | 171,6 | | 190,2 | |
| | 2./ | 30 $/t | - | | 194,4 | | 213,1 | |
| | 3./ | 50 $/t | 200,8 | | 224,9 | | 243,6 | |
| | 4./ | 70 $/t | 231,3 | | - | | - | |
| MAP 375 t/d /18% N, 52 % $P_2O_5$/ | | | 317,9 | | - | | - | |
| DAP 425 t/d /18 % N, 52% $P_2O_5$/ | | | 302,6 | | - | | - | |
| NPK 1040 t/d /19:19:19/ | | | 193,7 | | - | | - | |

Table 7-1.1

## Farm-gate prices

$/t

| Raw material | Product: Urea capacity 260 t/d | Urea capacity 440 t/d | Urea capacity 1700 t/d | Ammonium nitrate capacity 355 t/d | Ammonium nitrate capacity 591 t/d | Ammonium nitrate capacity 2364 t/d |
|---|---|---|---|---|---|---|
| **Natural gas** | | | | | | |
| **Seaside location** | | | | | | |
| 1. 1.8 $/Gcal | 294,7 | 237,2 | 306,7 | 247,5 | 206,2 | 289,3 |
| 2. 3.5 " | 302,2 | 245,3 | 313,7 | 253,1 | 212,2 | 294,4 |
| 3. 5.9 " | 312,4 | 256,9 | 323,5 | 260,5 | 220,7 | 301,7 |
| 4. 11.8 " | 337,6 | 285,1 | 347,5 | 279,1 | 241,6 | 319,5 |
| **Remote location** | | | | | | |
| 1. 1.8 $/Gcal | 329,3 | 267,2 | 370,3 | 278,7 | 234,2 | 351,6 |
| 2. 3.5 " | 336,6 | 275,4 | 377,4 | 284,1 | 240,3 | 356,7 |
| 3. 5.9 " | 346,8 | 286,9 | 387,2 | 291,6 | 248,8 | 364,0 |
| 4. 11.8 " | 372,1 | 315,1 | 411,4 | 310,3 | 269,5 | 381,8 |
| **Fuel oil** | | | | | | |
| **Seaside location** | | | | | | |
| 1. 12 $/Gcal | 362,1 | 306,4 | 378,6 | 297,1 | 257,2 | 342,0 |
| 2. 15 " | 375,5 | 321,3 | 392,7 | 307,0 | 268,2 | 352,3 |
| **Remote location** | | | | | | |
| 1. 12 $/Gcal | 400,1 | 339,8 | 448,7 | 331,0 | 287,6 | 409,1 |
| 2. 15 $Gcal | 413,5 | 354,7 | 462,8 | 340,8 | 298,6 | 419,5 |
| **Coal** | | | | | | |
| **Seaside location** | | | | | | |
| 1. 4.6 $/Gcal | 411,7 | 332,7 | 414,7 | 333,8 | 276,6 | 368,5 |
| 2. 9.1 " | 442,2 | 364,4 | 441,1 | 356,4 | 299,9 | 388,0 |
| 3. 13.6 " | 473,3 | 398,3 | 467,5 | 379,1 | 325,0 | 407,5 |
| **Remote location** | | | | | | |
| 1. 4.6 $/Gcal | 460,7 | 373,1 | 503,8 | 375,7 | 312,2 | 449,6 |
| 2. 9.1 " | 491,5 | 405,9 | 530,2 | 398,3 | 336,5 | 469,1 |
| 3. 13.6 " | 522,3 | 438,7 | 556,7 | 421,0 | 360,7 | 488,6 |

Farm gate prices of 1 t N

| Raw material: natural gas | Urea capacity | | | Ammonium nitrate capacity | | |
|---|---|---|---|---|---|---|
| | 260 t/d | 440 t/d | 1700 t/d | 355 t/d | 591 t/d | 2364 t/d |
| **Seaside location** | | | | | | |
| 1./ 1,8 $/Gcal | 641 | 516 | 667 | 728 | 606 | 851 |
| 2./ 3,5 " | 657 | 533 | 682 | 744 | 624 | 866 |
| 3./ 5,9 " | 679 | 558 | 703 | 766 | 649 | 887 |
| 4./ 11,8 " | 734 | 620 | 755 | 821 | 711 | 940 |
| **Remote location** | | | | | | |
| 1./ 1,8 $/Gcal | 716 | 581 | 805 | 820 | 689 | 1034 |
| 2./ 3,5 " | 732 | 599 | 820 | 836 | 707 | 1049 |
| 3./ 5,9 " | 754 | 624 | 842 | 858 | 732 | 1070 |
| 4./ 11,8 " | 809 | 685 | 894 | 913 | 793 | 1123 |

Appendix 3/1 Table 7-2

## Farm-gate prices

$/t

| | Developing site | |
|---|---|---|
| | Seaside location | Remote |
| **SSP** /500 t/d/ | | |
| phosph. rock | | |
| 1. 15 $/t | 63,5 | 72,1 |
| 2. 3o $/t | 72,2 | 8o,8 |
| 3. 5o $/t | 83,8 | 92,4 |
| 4. 7o $/t | - | - |
| **TSP** /500 t/d/ | | |
| phosph. rock | | |
| 1. 15 $/t | 186,6 | 2o5,2 |
| 2. 3o $/t | 2o9,4 | 228,1 |
| 3. 5o $/t | 239,9 | 258,6 |
| 4. 7o $/t | - | - |

## Appendix 3/2 - Brief introduction to the use of mathematicl programming

This appendix tries to give a short examination on the use of some computer-aided mathematical methods of decision making. No theoretical knowledge of these methods is expected from the reader. This brief inspection attempts to introduce the topic especially from a practical approach. As the theoretical results and practical facilities now provide a rather wide scale of sophisticated techniques, the example to be given below should not be considered characteristic to any real problem neither in its content nor in its technique, it should be taken only as an introductory excercise. In spite of this it may give some inspect tc the problems of mathematical programming.

Coming to a decision among several possible solutions is always a difficult matter. Among the reasons of this at the first place the troubles of gathering information in its most general sense should be mentioned. Information means not only the necessary technico-economic data to the given problem, it involves the knowledge of the special, local conditions, the expectations or wishes of the various groups and organs.

Appendix 3/2

Respectively, in an investment decision making it is always inevitable to adjust the various viewpoints and interests. For this purpose the elaborating of realistic, treatable model to the problem may give much help. Along this process the conflicting interests may be more objectively expressed through a model and the results drawn from it can be more easily regarded by the participants as reasonable consequences to be taken into consideration.

Some very characteristic problems of ecenomic mathematical modelling are shown below. /The viewpoint of this listing is the necessary special mathematical-computational treatment/:

1. Scheduling of production and sales

   Any producing unit may have the problem to find the best structure of production in the best timing and physical settling. The word "best" means either a technical or an economic objective.

2. Transportation problems

   Having a table of distances between possible sites special methods are available for the finding of the least total transportation cost.

Appendix 3/2

3. The fix charge problems of productions, sales, etc.

If one can not admit that the cost of production or saling is proportionate to the size of these activities some different methods should be applied. In the most simple case above the fix charges, like the over-all costs, interests, amortization, etc. the further costs may be regarded linear.

4. Investment problems

With investment problems often several questions similar to 1.-3. should be solved simultaneously. From the former parts of this study one can understand the several logical assumptions connected to problems of this kind. In addition, the goals themselves may be rather comlex. Here only just some possible separate goals are mentioned /there are some methods of taking more of them into consideration at the same time/:

- maximum of profits,
- minimum of costs,
- maximum of employment
- maximum of the balance of hard currency, etc.

Namely in connection with the modelling of satisfying fertilizer demands it may be useful to take the

Appendix 3/2

following aspects into consideration. There are several possible ways to meet some demand and, even within this, a number of variants may be realized. To make a thorough calculation for their economical results to be expected, all of them would require on the one side roundabout manual work and, on the other side such a calculation would still not necessarily represent the best possible solution /in the economical sense/, it may happen that a relatively small sacrifice /e. g. a little higher investment/ would result a far higher profit.

The problem may be drafted in the following form: what are the possible ways of meeting the demands and their fulfilment most economically, in other words finding the variants that yield supposing nearly equivalent expenditures /such as investment, energies, labour etc./ the highest sum of profit?

The question, however, may be given this way,too: which variant would satisfy the objective at the lowest possible expenditure /investment and production/?

One characteristic type tends to find the most economical product structure of a given unit /considering market conditions/ and to distribute the end product at the lowest possible cost namely with this

Appendix 3/2

present topic - to satisfy the fertilizer demands of a given country, territory, farm etc. most economically.

In such a case, production and investment variants may come from the following:

- the sort of the fertilizer and its raw material,
- its amount,
- the size,
- the technology,
- the site of the plant /plants/ to be established,
- the level of satisfying the demand etc.

It should be supposed that the demand might be fulfilled via buying /importing/ or by production; the plant to be established may have a size just to meet the local demands, but in pricnciple /if motivated by market and other conditions/ it might also provide other selling /e. g. for export/.

The described system is called a multivariable supply model; in order to provide data for it, naturally certain local conditions and technological data must be known, such as the available:

- sorts and quantities of raw materials,
- infrastructure,
- financial resources,
- labour, etc.

Appendix 3/2

The above indicated /and other possible/ factors determine, to a certain extent, the variants to be considered; they are called the constraints.

Accordingly, the model may be written as follows:

demand=production - export + import.

Within this, naturally, every factor may note several variants. The computer programme is able to handle all of them simultaneously, and to select, based on the data of the given variants, the solution which is most apt to the objective function. The drawing up of the objective function is always a task of the persons performing the examination and may be, on the basis of the different aspects, rather different.

As for an example which solution gives the lowest costs, the highest sum of profit, or requires the least labour, energy, infrastructure, /depending on the bottle-necks/, etc.?

Thus, the examination or series of examinations made as mentioned gives an answer to the question that which of the possible productions, investments and foreign trade activities /as variants/ are to be performed, in a given period, in order to meet a

Appendix 3/2

certain demand or requirement; what should be their size and proportion that they

- not exceed the limited resources(investment costs, raw materials, labour)
- give a minimum of the costs of a supply or a maximum of the profits (optimum programme).

Should, for some reason, the solution found by the computer programme (e.g., for meeting a demand) require further examination, there is no problem in performing this additional calculation. The numerical data and the objective functions of the model may be varied if necessary but introducing new variables or constraints into the system does not cause any technical obstacle either. One of the basic advantages of this analysing method is that new series of calculations may be quickly performed with rather complex problems, too.

The other advantage is that sensibility analyses may be accomplished, too. These show the effect of the modifying of the most important economic data /costs, prices, etc./ and constraints on the objective function and the optimum programme.

Naturally models are always less or more simplified images of reality and somewhat subjective in

Appendix 3/2

the sense that both the possibilities and the restraints together with their data basis may be disputed, nevertheless subjectivity is mostly limited to this area only. In connection with the compilation of a model the importance of the knowledge and skill of the local experts of the developing country cannot be emphasized enough. While most of the technical-economic data and the several, more or less plausible conditions may be elaborated even by foreign experts, they can not do without the support of the local experts in forming the special, local conditions.

It may be important to mention that even the most precise and complicated models can give an answer only to the questions of the model and not to the real problem. For this reason it is necessary to analyse the results with critics knowing that there were several factors that were not considered at all, or if they were limitations of model-making perhaps they did not render the theoretically best solutions possible.

At last, the building of the model and the changing of some interdepending elements should be a process parallel with the whole course of decision-

Appendix 3/2

making. It ought to have an active role in it. Only this way a model provide useful replies to the given questions, or may be new aspects for further investigations.

First here is an attempt to give a short information of the most widely spread technique called linear programming through presenting a numerical example. After some extentions of this method like the non-linear, the stochastic programming, etc. are shown with some practical remarks.

Let us assume that a country /a branch of industry, a firm, etc./ has the following problem: which is the relatively best way of satisfying a minimal home supply of a product "A" supposed that this should cause the maximal increase /or if this is not possible the least decrease/ in the balance of hard currency /given e.g. in million US $/? There are the possibilities of either a home production, where the surplus may be exported, or of the importation of "A". Let the home production basically depend on one important raw material, called "B" /also in 1000 tons/, where "B" is available.

Appendix 3/2

The specific use of "B" to "A" is a known amount. An other restriction is that both the home production of "A" and "B" and the foreign trade need some given amounts of manpower depending on the size of these activities, and the total of this manpower can not exceed an upper limit /given in persons/.
The per unit costs and incomes of the home productions and the foreign trade activities in the given hard currency /million US $/ are known as well.

A mathematical programming model generally has three basic elements. 1. the activities, 2. the objective function, and 3. the constraints.
The activities are the unknown variables of the problem. The set of these activities is often called the programme. /The term "mathematical programming" refers to this trying to make distinction from the other everyday meanings of the word "programming" and of the term "computer programming", which is the way of teaching an electronic computer/.

In this example these are only four activities /real great problems may have several thousands of them/:

$X_1$ = home production of"A",

$X_2$ = exportation of "A",

Appendix 3/2

$x_3$ = importation of "A",

$x_4$ = exportation of "B".

The task is to find the best of all the feasible solutions, the optimal one. The optimum criterion is always formed in an objective function in mathematical programming. Supposed that a unit of an activity causes the following changes in the balance of hard currency /in million US $/:

$x_1$ .....-9 /the cost of producting "A"/

$x_2$ .....-12 /the income from the exporting of "A"/

$x_3$ .....-14 /the cost of importing "A"/

$x_4$ .....+ 8 /the income from the exporting of "B"/

Now the objective function will have the following form:

$$y = 9x_1 + 12x_2 - 14x_3 + 8x_4.$$

The optimum /here this means the maximum/ of y is to be founded.

Having no restrictions in connection with the activities, the value of y might be unlimited. The system of these limitations /given in the mathamatical form/ are called the constraints of the problem.

This example is supposed to have three constraints:

1. The total consumption of "B" /the use to "A" de-

Appendix 3/2

pending on $x_1$ and the exportation $x_4$/ should not exceed a supposed given quantity /here, e.g.:20/. 0.4 tons of "B" is needed to produce a unit of "A":

$$0.4x_1 + x_4 \leq 20$$

2. Let the total available manpower be limited /e.g. 370/. Let the following number of persons be required to run a unit of an activity:

$x_1$ .....10
$x_2$ ..... 2
$x_3$ ..... 1
$x_4$ .....13

Supposed that the required manpower is proportional to the scale of any activity the following constraint may be written:

$$10x_1 + 2x_2 + 1x_3 + 13x_4 \leq 370$$

3. The minimal home supply of "A" should reach a supposed given value /here: 40/. This may be statisfied either through home production or foreign trade. Mixed solutions are also allowed:

$$x_1 - x_2 + x_3 \leq 40$$

The problem now is comlete. There are several methods known which are proper for solving this problem. One of the best known of these is called

Appendix 3/2

the Simplex Method. It would not be worth to show here any of these methods in their details because on the one hand it would be difficult to understand them without their mathematical background and on the other hand any of the problems of this type can bel solved by well elaborated and tested computer programmes generally available at all the computer centres.
/Real problems with much greater sizes technically are not executable in a manual way./

Any method of linear programming results the optimal solution to the given problem:

$$x_1 = 18.421,$$
$$x_2 = 0$$
$$x_3 = 21,579,$$
$$x_4 = 12.632$$

This optimal programme with the values of the unknown variables substituted into the equation of the objective function /y/ results the following.

$$y = -9 \times 18.421 + 12 \times 0 - 14 \times 21.579 + 8 \times 12.632$$

$$y = -366.842$$

Appendix 3/2

This programme does not give a positive balance of the hard currency but it is still the best within the given constraints.

It can be seen at this optimal solution, that the importance of the various constraints is not equal.

In other words, if the limits had been a unit less, what an increase would have they caused in the objective function? The computational methods give an answer to this question, too:

1. constraint ..... + 1.842,
2. constraint ..... 0.474,
3. constraint ..... -14.474

Obviously the bottle-neck the problem is the mimimum home supply of "A" /the 3 rd constraint/

Insisting on a unit increase of this home supply would cause more than 14 million US $ plus expenditure while on the other hand a unit surplus of the raw material "B" could improve the balance with nearly two million dollars.

Even from this very small example one can feèl the problems of model making the execution of the computations and the analysis of the results.

Theoretically, the proportionality of the costs

Appendix 3/2

and incomes to the size of the activity is not a plausible assumption. Some costs, like the fix charges of the foreign trade are quite independent of the turnover. The scale of economy of the investments is not linear either.

These problems may be treated properly through various methods of nonlinear programming. Problems with logical factors (e.g. where more activities are excluding each other/ or problems with given discrete scales /like the possible sizes of investments or the unknown number of machines, etc./ require similar treatment. The difference methods of nonlinear programming try to find optimal solutions to these problems but these methods are much more troublesome, more expensive regarding their practical utilization.

Different solutions may be needed from an even more complicated approach to these questions if one assumes that neither the inputs nor the outputs of the models are fixed /deterministic/ values. Allowing the constants of a model to be probability variables, that is supposing that they are also unsure values with certain mathematical characteristics a stoachastic model to the problem may be worked out.
Though probably the nonlinear and stoachstic models

Appendix 3/2

give the most appropriate description of the real circumstances, the modelling and especially the mathematical-computational problems are far not sufficiently solved yet. In spite of this one may take such factors into consideration in certain cases. Without any special selecting principle some works dealing with these problems in details are mentioned in Referende.

In the framework of an appendix it is impossible touch all the problems connected to the whole topic. The purpose was only to give some methodological introduction. A basic problem was not mentioned yet, that the well organized cooperation of the special technical, economic and computer experts gives the clue to the application of any of these methods. Only assuming this teamwork it may be guaranteed that the expenses of a computer aided mathematical project return through the more objective, more realistic decisions coming from the variants that one could have not known without these modern facilities.

Appendix 3/2

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Appendix 4/1 - Fertilizer consumption in developing countries in 1976/77 - 1980/81

N - CONSUMPTION

1000 t N

Table 1/1

Category I /less than 1000 t/

| Name | 1976/77 Total | 1976/77 From Total U | 1976/77 From Total AN | 1981/82 Total | 1981/82 From Total U | 1981/82 From Total AN | Notice |
|---|---|---|---|---|---|---|---|
| 1. AFRICA | | | | | | | |
| North-West Africa | - | | | - | | | |
| West Africa | | | | | | | |
| Benin | Cat: II. | | | 0,58 | | 0,4 | |
| Gambia | 0,2 | | | Cat: II. | | | |
| Guinea | 0,6 | | | 0,5 | | | |
| Guinea Bissau | 0,1 | | | Cat: II. | | | |
| Mauritania | 0,5 | | | Cat: II. | | | |
| Niger | 0,56 | 0,4 | | Cat: II. | | | |
| Sierra Leone | 0,53 | 0,1[2] | | Cat: II. | | | |
| Togo | 0,95 | 0,1[2] | | Cat: II. | | | |
| Central Africa | | | | | | | |
| Congo | 0,12 | | | 0,15 | | | |
| Eq. Guinea | 0,1 | | | 0,1[1] | | | |
| Gabon | 0,38 | | | 0,8 | | | |
| East and Southern Africa | | | | | | | |
| Botswana | Cat: II. | | | 0,6 | | | |
| Burundi | 0,47 | | 0,2 | 0,3 | | | |
| Djibouti | 0,5 | | | 0,85[2] | | | |
| Lesotho | 0,3 | | | 0,5 | | | |
| Rwanda | 0,16 | | | 0,1 | | | |
| Uganda | 0,96 | | 0,3 | 0,5 | | | |

Remarks to all the tables in Appendix 4/1:

1 - Consumption in 1980/81
Source: FAO Fertilizer Yearbook, 1981.

2 - Data from papers prepared for UNIDO Seminar, Lahore, November 1982.

N-CONSUMPTION, 1000 t N
Category I

| Name | 1976/77 Total | 1976/77 From Total U | 1976/77 From Total AN | 1981/82 Total | 1981/82 From Total U | 1981/82 From Total AN | Notice |
|---|---|---|---|---|---|---|---|
| 2. LATIN AMERICA | | | | | | | |
| Central America | | | | | | | |
| Belize | 0,3 | 0,1[2] | | 0,5 | | | |
| Caribbean | | | | | | | |
| Bahamas | 0,53 | | | 0,5 | | | |
| St. Kitts-Nevis | 0,3 | | | 0,4 | | | |
| St. Lucia | Cat: II. | | | 0,8 | | | |
| South America | | | | | | | |
| Fr. Guiana | - | | | 0,2 | | | |
| Paraguay | 0,5 | | | Cat: II. | | | |
| 3. NEAR EAST | | | | | | | |
| N.E. Africa | - | | | - | | | |
| N.E. Asia | | | | | | | |
| Kuwait | - | | | 0,28[2] | | | |
| Oman | 0,13 | | | 1,0 | | | |
| Qatar | 0,3 | | | 0,84 | | | |
| U.A. Emirates | 1,0 | | | Cat: II. | | | |
| Yemen PDR | 0,8 | 0,8 | | Cat: II. | | | |
| 4. FAR EAST | | | | | | | |
| South Asia | | | | | | | |
| Bhutan | 0,1 | | | 0,1 | | | |

N-CONSUMPTION, 1000 t N
Category I

| Name | 1976/77 | | | 1981/82 | | | Notice |
|---|---|---|---|---|---|---|---|
| | Total | From Total | | Total | From Total | | |
| | | U | AN | | U | AN | |
| East and South-East Asia | | | | | | | |
| Kampuchea DM | 0,1 | | | Cat: III. | | | |
| Laos | 0,1 | | | Cat: II. | | | |
| 5. OCEANIA | | | | | | | |
| Fr. Polynesia | 0,2 | | | 0,4 | | | |
| New Caledonia | 0,17 | | | 0,5 | | | |
| Samoa | 0,01 | | | 0,15 | | | |

# N - C O N S U M P T I O N

1000 t N

Category II /1-10/

| Name | 1976/77 Total | 1976/77 From Total U | 1976/77 From Total AN | 1981/82 Total | 1981/82 From Total U | 1981/82 From Total AN | Notice |
|---|---|---|---|---|---|---|---|
| 1. AFRICA | | | | | | | |
| North-West Africa | - | | | - | | | |
| West Africa | | | | | | | |
| Benin | 1,0 | | | Cat: I. | | | |
| Gambia | Cat: I. | | | 2,4 | 0,13 | | |
| Guinea Bissau | Cat: I. | | | 1,2 | | | |
| Liberia | 4,3 | | 3,5 | 2,0[1] | | | |
| Mali | 4,5 | | | 5,7 | | | |
| Mauritania | Cat: I. | | | 1,2[2] | | | |
| Niger | Cat: I. | | | 1,7 | | | |
| Senegal | Cat: III. | | | 6,3 | | | |
| Sierra Leone | Cat: I. | | | 1,3 | 0,17 | | |
| Togo | Cat: I. | | | 1,2 | 0,51 | | |
| Upper Volta | 2,2 | | | 1,6 | 0,32 | | |
| Central Africa | | | | | | | |
| Angola | 1,0 | | | 4,6 | | | |
| Cameroon | 4,0 | | | Cat: III. | | | |
| Centr. Afr. Rep. | 1,2 | | | 1,2 | | | |
| Chad | 3,1 | | | 1,6 | | | |
| Congo | - | | | - | | | |
| Zaire | 6,2 | 6,2 | | 2,5 | 2,5 | | |

N-CONSUMPTION, 1000 t N
Category II

| Name | 1976/77 Total | 1976/77 From Total U | 1976/77 From Total AN | 1981/82 Total | 1981/82 From Total U | 1981/82 From Total AN | Notice |
|---|---|---|---|---|---|---|---|
| East and Southern Africa | | | | | | | |
| Madagascar | 3,9 | 3,3 | | 3,5 | | | |
| Mauritius | 8,8 | | | 9,5 | | 1,1 | |
| Mozambique | 6,7 | | | Cat: III. | | | |
| Reunion | 4,1 | | | 5,3 | | | |
| Somalia | ... | | | 1,3[2] | | | |
| Swaziland | 1,0 | | | 8,5 | | | |
| 2. LATIN AMERICA | | | | | | | |
| Central America | - | | | - | | | |
| Caribbean | | | | | | | |
| Barbados | 1,9 | | | 2,0 | | | |
| Dominica | 1,6 | | | 1,0 | | | |
| Guadeloupe | 3,4 | 0,43 | 0,07 | 3,3 | 0,02 | | |
| Haiti | | | | 3,0 | | | |
| Jamaica | 7,3 | | | Cat: III. | | | |
| Martinique | 3,6 | 9,18 | 0,03 | 4,3 | 2,9 | | |
| St. Lucia | 1,6 | | | Cat: I. | | | |
| St. Vincent | 2,1 | | | 2,4 | | | |
| South America | | | | | | | |
| Bolivia | 1,3 | | | 2,7 | | | |
| Guyana | 6,0 | | | 9,3 | 1,8 | | |
| Paraguay | 6,1 | | | 2,3 | 0,77 | | |
| Suriname | 3,4 | | | 5,4 | | | |
| Trinidad a. Tobago | 4,5 | | | 2,8 | 0,39 | | |

N-CONSUMPTION, 1000 t N
Category II

| Name | 1976/77 Total | 1976/77 From Total U | 1976/77 From Total AN | 1981/82 Total | 1981/82 From Total U | 1981/82 From Total AN | Notice |
|---|---|---|---|---|---|---|---|
| 3. NEAR EAST | | | | | | | |
| N.E. Africa | - | | | - | | | |
| N.E. Asia | | | | | | | |
| Cyprus | 6,3 | | | 9,0 | 1,3 | 2,0 | |
| Jordan | 4,0 | | | 2,9 [2] | | | |
| Saudi-Arabia | 6,4 | | | Cat: IV. | | | |
| U.A. Emirates | Cat: I. | | | 2,4 [2] | 0,7 | | |
| Yemen AR | 3,4 | | | Cat: III. | | | |
| Yemen PDR | Cat:I. | | | 1,7 | | | |
| 4. FAR EAST | | | | | | | |
| South Asia | - | | | - | | | |
| East and South Asia | | | | | | | |
| Laos | Cat: I. | | | 4,0 | | | |
| Mongolia | 4,4 | | | 7,5 | | | |
| Singapure | Cat: I. | | | 2,0 | | | |
| 5. OCEANIA | | | | | | | |
| Fiji | 9,0 | | | Cat: III. | | | |

Appendix 4/1 Table 1/3

N - C O N S U M P T I O N

1000 t N

Category III /10-40/

| Name | 1976/77 Total | 1976/77 From Total U | 1976/77 From Total AN | 1981/82 Total | 1981/82 From Total U | 1981/82 From Total AN | Notice |
|---|---|---|---|---|---|---|---|
| 1. AFRICA | | | | | | | |
| North-West Africa | | | | | | | |
| Tunisia | 24,9 | | | 30,5 | | | |
| West Africa | | | | | | | |
| Ghana | 12,0 | | | 15,0 | | | |
| Ivory Coast | 12,0 | | | 11,3 | | | |
| Nigeria | 35,0 | | | Cat: V. | | | |
| Senegal | 10,8 | | | Cat: II. | | | |
| Central Africa | | | | | | | |
| Cameroon | Cat: II. | | | 22,7 | | | |
| East and Southern Africa | | | | | | | |
| Ethiopia | 11,0 | | | 16,0 | | | |
| Kenya | 22,4 | 1,7 | 3,5 | 33,9 | | | 2 / 1981/82 total: 44, U: 4,8 |
| Malawi | 18,9 | | 1,6 | 14,3 | | | |
| Mozambique | Cat: II. | | | 20,1 | | | |
| Tanzania | 13,3 | 2,3 | 2,3 | 17,5 | | | |
| Zambia | 39,8 | | | Cat: IV. | | | |
| 2. LATIN AMERICA | | | | | | | |
| Central America | | | | | | | |
| Costa Rica | 28,5 | | | Cat: IV. | | | |
| Honduras | 11,0 | | | 16,7 | | | |
| Nicaragua | 22,9 | | | 39,0 | | | |
| Panama | 11,0 | | | 13,9 | | | |

Table 1/3 /cont./

N-CONSUMPTION, 1000 t N
Category III

| Name | 1976/77 Total | 1976/77 From Total U | 1976/77 From Total AN | 1981/82 Total | 1981/82 From Total U | 1981/82 From Total AN | Notice |
|---|---|---|---|---|---|---|---|
| **Caribbean** | | | | | | | |
| Dominican Rep. | 35,0 | | | 31,4 | | | |
| Jamaica | Cat: II. | | | 10,2 | 1,7 | | |
| **South America** | | | | | | | |
| Argentina | 39,2 | | | Cat: IV. | | | |
| Ecuador | Cat: IV. | | | 34,8 | | | |
| Uruguay | 17,9 | 5,4 | | 20,4 | | | |
| **3. NEAR EAST** | | | | | | | |
| **N.E. Africa** | | | | | | | |
| Libya | 13,1 | | | 30,5 | | | |
| **N.E. Asia** | | | | | | | |
| Afghanistan | 30,6 | 25,8 | | 25,6 | | | |
| Cyprus | 15,0 | | | Cat: II. | | | |
| Iraq | 35,0 | | | Cat: IV. | | | |
| Lebanon | 17,7 | | | 16,9 | | | |
| Yemen AR | Cat: II. | | | 10,6 | | | |
| **4. FAR EAST** | | | | | | | |
| **South Asia** | | | | | | | |
| Nepal | 10,7 | 6,3 | | 17,4 | 12,3 | | |
| **East and South-East Asia** | | | | | | | |
| Kampuchea DM | Cat: I. | | | 10,5 | | | |
| **5. OCEANIA** | | | | | | | |
| Fiji | Cat: II. | | | 12,8 | | | |

# N - C O N S U M P T I O N

1000 t N

Category IV /40-70/

| Name | 1976/77 Total | 1976/77 From Total U | 1976/77 From Total AN | 1981/82 Total | 1981/82 From Total U | 1981/82 From Total AN | Notice |
|---|---|---|---|---|---|---|---|
| 1. AFRICA | | | | | | | |
| North-West Africa | | | | | | | |
| Algeria | 51,0 | | | 71,0 | | | |
| West Africa | - | | | - | | | |
| Central Africa | - | | | - | | | |
| East and Southern Africa | | | | | | | |
| Zambia | Cat: III. | | | 57,6 | | | |
| Zimbabwe | 39,8 | | | Cat: VI. | | | |
| 2. LATIN AMERICA | | | | | | | |
| Central America | | | | | | | |
| Costa Rica | Cat: III. | | | 45,2 | | | |
| El Salvador | Cat: V. | | | 66,5 | 2,5 | | |
| Guatemala | 49,9 | | | 52,5 | | | |
| Caribbean | - | | | - | | | |
| South America | | | | | | | |
| Argentina | Cat: III. | | | 51,2 | | | |
| Chile | 48,7 | 9,7 | | 48,2 | 22,1 | | |
| Ecuador | 49,5 | | | Cat: III. | | | |

N-CONSUMPTION, 1000 t N
Category IV

| Name | 1976/77 Total | 1976/77 From Total U | 1976/77 From Total AN | 1981/82 Total | 1981/82 From Total U | 1981/82 From Total AN | Notice |
|---|---|---|---|---|---|---|---|
| 3. NEAR EAST | | | | | | | |
| N.E. Africa | - | | | - | | | |
| N.E. Asia | | | | | | | |
| Iraq | Cat: III. | | | 63,6 | | 9,9 | |
| Saudi Arabia | Cat: II. | | | 41,3 | | | |
| Syria | 48,1 | | | Cat: V. | | | |
| 4. FAR EAST | | | | | | | |
| South Asia | | | | | | | |
| Sri Lanka | 52,3 | | 31,4 | Cat: V. | | | |
| East and South-East Asia | | | | | | | |
| Burma | 42,9 | | 42,9 | Cat: VI. | | | |
| 5. OCEANIA | - | | | - | | | |

# N - C O N S U M P T I O N

1000 t N

Category V /70-100/

| Name | 1976/77 Total | 1976/77 From Total U | 1976/77 From Total AN | 1981/82 Total | 1981/82 From Total U | 1981/82 From Total AN | Notice |
|---|---|---|---|---|---|---|---|
| 1. AFRICA | | | | | | | |
| North-West Africa | | | | | | | |
| Morocco | 82,2 | | | 81,1 | | | |
| West Africa | | | | | | | |
| Nigeria | Cat: III. | | | 96,7 | | | |
| Central Africa | - | | | - | | | |
| East and Southern Africa | - | | | - | | | |
| 2. LATIN AMERICA | | | | | | | |
| Central America | | | | | | | |
| El Salvador | 77,1 | | | Cat: IV. | | | |
| Caribbean | - | | | - | | | |
| South America | | | | | | | |
| Venezuela | 74,3 | | | 69,6 | 32,5 | o,5 | |
| 3. NEAR EAST | | | | | | | |
| N.E. Africa | - | | | - | | | |
| Sudan | 80,0 | | | 74,5 | | | |
| N.E. Asia | | | | | | | |
| Syria | Cat: IV. | | | 83,1 | 15,9 | 66,0 | |

Table 1/5 /cont./

N-CONSUMPTION, 1000 t N
Category V

| Name | 1976/77 Total | 1976/77 From Total U | 1976/77 From Total AN | 1981/82 Total | 1981/82 From Total U | 1981/82 From Total AN | Notice |
|---|---|---|---|---|---|---|---|
| 4. FAR EAST | | | | | | | |
| South Asia | | | | | | | |
| Sri Lanka | Cat: IV. | | | 88,9 | 67,5 | | |
| East and South-East Asia | | | | | | | |
| Malaysia | 90,0 | | | Cat: VI. | | | |
| 5. OCEANIA | - | | | - | | | |

Appendix 4/1 Table 1/6

## N - C O N S U M P T I O N

1000 t N

Category VI /100-200/

| Name | 1976/77 Total | 1976/77 From Total U | 1976/77 From Total AN | 1981/82 Total | 1981/82 From Total U | 1981/82 From Total AN | Notice |
|---|---|---|---|---|---|---|---|
| 1. AFRICA | | | | | | | |
| North-West Africa | - | | | - | | | |
| West Africa | - | | | - | | | |
| Central Africa | - | | | - | | | |
| East and Southern Africa | | | | | | | |
| Zimbabwe | Cat: IV. | | | 106,7 | 36,5 | 69,9 | |
| 2. LATIN AMERICA | | | | | | | |
| Central America | - | | | - | | | |
| Caribbean | | | | | | | |
| Cuba | 187,2 | | | Cat: VII. | | | |
| South America | | | | | | | |
| Colombia | 142,7 | 90,9 | 7,5 | 135,3 | | | |
| Peru | 100,3 | 57,4 | 26,5 | 100,6 | | | |
| 3.NEAR EAST | | | | | | | |
| N.E. Africa | - | | | - | | | |
| N.E. Asia | - | | | - | | | |
| 4. FAR EAST | | | | | | | |
| South Asia | | | | | | | |
| Bangladesh | 167,8 | 165,8 | | Cat: VII. | | | |

N-CONSUMPTION, 1000 t N
Category VI

| Name | 1976/77 Total | 1976/77 From Total U | 1976/77 From Total AN | 1981/82 Total | 1981/82 From Total U | 1981/82 From Total AN | Notice |
|---|---|---|---|---|---|---|---|
| East and South-East Asia | | | | | | | |
| Burma | Cat: IV. | | | 110,0 | 110,0 | | |
| Malaysia | Cat: V. | | | 127,9[2] | | | 2/ Total: 139; U: 35,9 |
| Philippines | 172,2 | 103,9 | | Cat: VII. | | | |
| Thailand | 136,3 | | | 162,0 | | | |
| Viet Nam | Cat: VII. | | | 199,7 | | | |
| 5. OCEANIA | - | | | - | | | |

Appendix 4/1

Table 1/7

N - C O N S U M P T I O N

1000 t N

Category VII /Over 200/

| Name | 1976/77 Total | 1976/77 From Total U | 1976/77 From Total AN | 1981/82 Total | 1981/82 From Total U | 1981/82 From Total AN | Notice |
|---|---|---|---|---|---|---|---|
| 1. AFRICA | | | | | | | |
| North-West Africa | - | | | - | | | |
| West Africa | - | | | - | | | |
| Central Africa | - | | | - | | | |
| East and Southern Africa | - | | | - | | | |
| 2. LATIN AMERICA | | | | | | | |
| Central America | | | | | | | |
| Mexico | 830,4 | | | 1111,7 | 403,0 | 46,8 | |
| Caribbean | | | | | | | |
| Cuba | Cat: VI. | | | 307,1 | | | |
| South America | | | | | | | |
| Brazil | 498,3 | 104,0 | 75,3 | 667,7 | | | |
| 3. NEAR EAST | | | | | | | |
| N.E. Africa | | | | | | | |
| Egypt | 427,7 | 113,5 | 252,8 | 585,0 | | | |
| N.E. Asia | | | | | | | |
| Iran | 220,5 | 147,7 | 4,2 | 386,6 | | | |
| Turkey | 590,7 | | | 776,4 | | | |

N-CONSUMPTION, 1000 t N
Category VII

| Name | 1976/77 Total | 1976/77 From Total U | 1976/77 From Total AN | 1981/82 Total | 1981/82 From Total U | 1981/82 From Total AN | Notice |
|---|---|---|---|---|---|---|---|
| 4. FAR EAST | | | | | | | |
| South Asia | | | | | | | |
| Bangladesh | Cat: VI. | | | 250,9 | 238,6 | | |
| India | 2351,7 | 1720,0 | 178,3 | 3881,7 | 3083,0 | 119,2 | |
| Pakistan | 554,0 | 397,0 | 22,1 | 832,6 | 607,0 | 72,4 | |
| East and South-East Asia | | | | | | | |
| China | 4755,0 | | | 11528,0 | | | |
| Indonesia | 351,2 | | | 997,1 | 929,6 | | |
| Korea DPR | 385,8 | | | 564,1 | | | |
| Korea Rep | 361,3 | 243,1 | | 431,8 | 235,3 | | |
| Philippines | Cat: VI. | | | 209,9 | | | |
| Viet Nam | 241,5 | | | Cat: VI. | | | |
| 5. OCEANIA | - | | | - | | | |

Appendix 4/1

Table 2/1

## $P_2O_5$ - C O N S U M P T I O N

1000 t $P_2O_5$

Category I /less than 1000 t/

| Name | 1976/77 | | | 1981/82 | | | Notice |
|---|---|---|---|---|---|---|---|
| | Total | From Total | | Total | From Total | | |
| | | SSP | TSP | | SSP | TSP | |
| 1. AFRICA | | | | | | | |
| North-West Africa | - | | | - | | | |
| West Africa | | | | | | | |
| Benin | ... | | | 0,35 | | 0,21 | |
| Niger | 0,53 | 0,48 | 0,007 | Cat: II. | | | |
| Sierra Leone | 0,53 | | | Cat: II. | | | |
| Guinea | 0,3 | | | Cat: II. | | | |
| Mauritania | ... | | | ... | | | |
| Central Africa | | | | | | | |
| Centr. Afr. Rep. | 0,2 | | | 0,03 | | | |
| Congo | 0,1 | | | 0,19 | | | |
| Gabon | 0,2 | | | 0,14 | | | |
| East and Southern Africa | | | | | | | |
| Botswana | 1,0 | | | 0,8 | | | |
| Burundi | 0,04 | | 0,02 | 0,4 | | | |
| Madagascar | 0,83 | | 0,62 | Cat: II. | | | |
| Rwanda | 0,08 | | | 0,1 | | | |
| Uganda | 0,43 | | | 0,1 | | | |
| Somalia | ... | | | ... | | | |
| 2. LATIN AMERICA | | | | | | | |
| Central America | | | | | | | |
| Belize | 0,6 | | | 0,56 | | | |
| Caribbean | | | | | | | |
| Bahamas | 0,53 | | | 0,4 | | | |
| Dominica | Cat: II. | | | 0,7 | | | |

$P_2O_5$-CONSUMPTION, 1000 $P_2O_5$
Category I

| Name | 1976/77 Total | 1976/77 From Total SSP | 1976/77 From Total TSP | 1981/82 Total | 1981/82 From Total SSP | 1981/82 From Total TSP | Notice |
|---|---|---|---|---|---|---|---|
| Haiti | 0,1 | | | Cat: II. | | | |
| St. Kitts-Nevis | 0,5 | | | 0,7 | | | |
| St. Lucia | 0,8 | | | 0,1 | | | |
| St. Vincent | 0,4 | | | 0,5 | | | |
| South America | | | | | | | |
| Paraguay | 0,3 | | | Cat: II. | | | |
| Trinidad a. Tobago | 0,27 | | | 0,65 | | | |
| Suriname | 0,66 | | | 0,3 | | | |
| 3. NEAR EAST | | | | | | | |
| N.E. Africa | - | | | - | | | |
| Sudan | ... | | | ... | | | |
| N.E. Asia | | | | | | | |
| Oman | 0,1 | | | 0,3 | | | 2 / 1981: 0,16 |
| U.A. Emirates | 0,1 | | | 0,97 | 0,06 | | |
| Yemen AR | 0,08 | | | 0,9 | | | |
| Yemen PDR | 0,07 | | 0,07 | 0,08 | 0,08 | | |
| 4. FAR EAST | | | | | | | |
| South Asia | - | | | - | | | |
| East and South-East Asia | | | | | | | |
| Kampuchea DM | ... | | | Cat: II. | | | |
| Singapure | 1,0 | | | 0,5 | | | |
| Laos | ... | | | ... | | | |
| 5. OCEANIA | | | | | | | |
| Fr. Polynesia | 0,07 | | | 0,3 | | | |
| New Caledonia | 0,06 | | | 0,02 | | | |
| Samoa | ... | | | 0,15 | | | |

## $P_2O_5$ - C O N S U M P T I O N

1000 t $P_2O_5$

Category II /1-10/

| Name | 1976/77 Total | 1976/77 From Total SSP | 1976/77 From Total TSP | 1981/82 Total | 1981/82 From Total SSP | 1981/82 From Total TSP | Notice |
|---|---|---|---|---|---|---|---|
| 1. AFRICA | | | | | | | |
| North-West Africa | - | | | - | | | |
| West Africa | | | | | | | |
| Gambia | 1,4 | | | 2,8 | 1,3 | | |
| Ghana | 5,2 | | | 8,0 | | | |
| Guinea | Cat: I. | | | 1,2 | | | |
| Ivory Coast | 6,3 | | | Cat: III. | | | |
| Liberia | 1,2 | | | 2,4 | | | |
| Mali | 4,2 | | | 3,9 | | | |
| Niger | Cat: I. | | | 1,7 | | | |
| Senegal | Cat: III. | | | 8,0 | | | |
| Sierra Leone | Cat: I. | | | 1,3 | 0,04 | | |
| Togo | 1,1 | | | 1,3 | 0,05 | o,17 | |
| Upper Volta | 2,2 | | | 2,2 | | | |
| Central Africa | | | | | | | |
| Angola | 0,6+ | | | 4,8 | | | +/ it is always more than 1,0 except in 1976 |
| Cameroon | 2,2 | | | 9,0 | | | |
| Chad | 2,0 | | | 1,0 | | | |
| Zaire | 5,2 | | 5,2 | 2,5 | | 2,5 | |
| East and Southern Africa | | | | | | | |
| Lesotho | 1,0 | | | 4,0 | | | |
| Madagascar | Cat: I. | | | 1,4 | | | |
| Malawi | 3,2 | 0,04 | 0,09 | 7,1 | | | |

Table 2/2 /cont./

$P_2O_5$-CONSUMPTION, 1000 t $P_2O_5$
Category II

| Name | 1976/77 Total | 1976/77 From Total SSP | 1976/77 From Total TSP | 1981/82 Total | 1981/82 From Total SSP | 1981/82 From Total TSP | Notice |
|---|---|---|---|---|---|---|---|
| Mauritius | 2,3 | 0,2 | 0,7 | 2,9 | 0,11 | 0,9 | |
| Mozambique | 2,9 | | | Cat: III. | | | |
| Reunion | 3,7 | | | 5,0 | | | |
| Swaziland | 1,5 | | | 5,7 | | | |
| Tanzania | Cat: III. | | | 8,5 | | | |
| 2. LATIN AMERICA | | | | | | | |
| Central America | | | | | | | |
| Honduras | 9,0 | | | 4,2 | | | |
| Nicaragua | Cat: III. | | | 7,5 | | | |
| Panama | 4,2 | | | 6,3 | | | |
| Caribbean | | | | | | | |
| Barbados | 1,2 | | | 1,0 | | | |
| Dominica | 1,3 | | | Cat: I. | | | |
| Guadeloupe | 3,3 | | 0,13 | 3,2 | | | |
| Haiti | Cat: I. | | | 1,4 | | | |
| Jamaica | 1,3 | | | 2,9 | | | |
| Martinique | 5,1 | 0,1 | | 2,7 | | | |
| South America | | | | | | | |
| Bolivia | 1,5 | | | 3,5 | | | |
| Guyana | 2,7 | | | 3,9 | | | |
| Paraguay | Cat: I. | | | 4,9 | 0,1 | 0,8 | |

Appendix 4/1

Table 2/2 /cont./

$P_2O_5$-CONSUMPTION, 1000 t $P_2O_5$
Category II

| Name | 1976/77 Total | 1976/77 From Total SSP | 1976/77 From Total TSP | 1981/82 Total | 1981/82 From Total SSP | 1981/82 From Total TSP | Notice |
|---|---|---|---|---|---|---|---|
| 3. NEAR EAST | | | | | | | |
| N.E. Africa | - | | | - | | | |
| N.E. Asia | | | | | | | |
| Cyprus | 10,0 | | | 5,5 | | | |
| Iraq | 8,0 | | | Cat: III. | | | |
| Jordan | 3,2 | | | 3,3 | | | |
| Lebanon | Cat: III. | | | 8,0 | | | |
| Saudi Arabia | 0,5+ | | | Cat: III. | | | +/ it is always more than 1,0 except in 1976 |
| 4. FAR EAST | | | | | | | |
| South Asia | | | | | | | |
| Nepal | 2,8 | | | 4,0 | | 0,04 | |
| East and South-East Asia | | | | | | | |
| Burma | 6,7 | | 6,7 | Cat: IV. | | | |
| Kampuchea DM | Cat: I. | | | 7,5 | | | |
| Mongolia | 2,6 | | | 6,1 | | | |
| 5. OCEANIA | | | | | | | |
| Fiji | 1,4 | 1,4 | | 3,3 | 3,3 | | |
| Papua New Guinea | 0,7+ | | | 2,3 | | | +/ it is always more than 1,0 except in 1976 |

# $P_2O_5$ - C O N S U M P T I O N

1000 t $P_2O_5$

Category III /10-40/

| Name | 1976/77 Total | 1976/77 From Total SSP | 1976/77 From Total TSP | 1981/82 Total | 1981/82 From Total SSP | 1981/82 From Total TSP | Notice |
|---|---|---|---|---|---|---|---|
| 1. AFRICA | | | | | | | |
| North-West Africa | | | | | | | |
| Tunesia | 26,9 | | | Cat: IV. | | | |
| West Africa | | | | | | | |
| Ivory Coast | Cat: II. | | | 11,5 | | | |
| Nigeria | 30,0 | | | Cat: V. | | | |
| Senegal | 16,4 | | | Cat: II. | | | |
| Central Africa | - | | | - | | | |
| East and Southern Africa | | | | | | | |
| Ethiopia | 16,2 | | | 30,0 | | | |
| Kenya | 27,3 | | 6,3 | 36,0[2] | 2,8 | 3,7 | |
| Mozambique | Cat: II. | | | 15,0 | | | |
| Tanzania | 11,0 | | 5,6 | Cat: II. | | | |
| Zambia | 17,9 | | | 21,1 | | | |
| 2. LATIN AMERICA | | | | | | | |
| Central America | | | | | | | |
| Costa Rica | 10,4 | | | 12,0 | | | |
| El Salvador | 16,4 | | | 20,1 | | | |
| Guatemala | 26,7 | | | 27,8 | | | |
| Nicaragua | 14,0 | | | Cat: II. | | | |

$P_2O_5$-CONSUMPTION, 1000 t $P_2O_5$
Category III

| Name | 1976/77 Total | 1976/77 From Total SSP | 1976/77 From Total TSP | 1981/82 Total | 1981/82 From Total SSP | 1981/82 From Total TSP | Notice |
|---|---|---|---|---|---|---|---|
| Caribbean | | | | | | | |
| Dominican Rep | 21,4 | | | 11,0 | | | |
| South America | | | | | | | |
| Argentina | 34,8 | | | 40,0 | | | |
| Ecuador | 13,3 | | | 15,7 | | | |
| Peru | 17,0 | 1,6 | 3,3 | 18,3 | 1,6 | 7,2 | |
| 3. NEAR EAST | | | | | | | |
| N.E. Africa | | | | | | | |
| Libya | 26,6 | | | Cat: IV. | | | |
| N.E. Asia | | | | | | | |
| Afghanistan | 13,6 | | 1,1 | 11,1 | | | |
| Iraq | Cat: II. | | | 13,1 | | | |
| Lebanon | 12,0 | | | Cat: II. | | | |
| Saudi Arabia | Cat: II. | | | 23,6 | | | |
| Syria | 20,5 | | 20,5 | Cat: IV. | | | |
| 4. FAR EAST | | | | | | | |
| South Asia | | | | | | | |
| Sri Lanka | 14,5 | | | 29,9 | | 17,3 | |
| East and South-East Asia | | | | | | | |
| Viet Nam | Cat: V. | | | 28,2 | | | |
| 5. OCEANIA | - | | | - | | | |

Appendix 4/1

Table 2/4

## $P_2O_5$ - C O N S U M P T I O N

1000 t $P_2O_5$

Category IV /40-70/

| Name | 1976/77 Total | 1976/77 From Total SSP | 1976/77 From Total TSP | 1981/82 Total | 1981/82 From Total SSP | 1981/82 From Total TSP | Notice |
|---|---|---|---|---|---|---|---|
| 1. AFRICA | | | | | | | |
| North-West Africa | | | | | | | |
| Tunisia | Cat: III. | | | 49,1 | | | |
| West Africa | - | | | - | | | |
| Central Africa | - | | | - | | | |
| East and Southern Africa | | | | | | | |
| Zimbabwe | 43,0 | | | 45,4 | 31,3 | 14,1 | |
| 2. LATIN AMERICA | | | | | | | |
| Central America | - | | | - | | | |
| Caribbean | | | | | | | |
| Cuba | 52,5 | | | Cat: V. | | | |
| South America | | | | | | | |
| Chile | 59,1 | 2,9 | 37,2 | 52,6 | | 35,6 | |
| Colombia | 68,9 | | | Cat: V. | | | |
| Uruguay | 52,1 | 9,9 | 1,7 | 39,7 | | | |
| Venezuela | 46,8 | | | 45,8 | | 2,2 | |
| 3. NEAR EAST | | | | | | | |
| N.E. Africa | | | | | | | |
| Egypt | 66,4 | 66,4 | | Cat: VI. | | | |
| Libya | Cat: III. | | | 45,0 | | | |

Appendix 4/1

Table 2/4 /cont./

$P_2O_5$-CONSUMPTION, 1000 t $P_2O_5$
Category IV

| Name | 1976/77 Total | 1976/77 From Total SSP | 1976/77 From Total TSP | 1981/82 Total | 1981/82 From Total SSP | 1981/82 From Total TSP | Notice |
|---|---|---|---|---|---|---|---|
| N.E. Asia | | | | | | | |
| Syria | Cat: III. | | | 46,4 | | 42,2 | |
| 4. FAR EAST | | | | | | | |
| South Asia | | | | | | | |
| Bangladesh | 61,1 | | 61,1 | Cat: VI. | | | |
| East and South-East Asia | | | | | | | |
| Burma | Cat: II. | | | 45,0 | | 45,0 | |
| Malaysia | 67,7 | | | Cat: V. | | | |
| Philippines | 40,0 | | | 51,2 | | | |
| 5 OCEANIA | - | | | - | | | |

Appendix 4/1

## $P_2O_5$ - C O N S U M P T I O N

1000 t $P_2O_5$

Table 2/5

Category V /70-100/

| Name | 1976/77 Total | 1976/77 From Total SSP | 1976/77 From Total TSP | 1981/82 Total | 1981/82 From Total SSP | 1981/82 From Total TSP | Notice |
|---|---|---|---|---|---|---|---|
| 1. AFRICA | | | | | | | |
| North-West Africa | | | | | | | |
| Algeria | 85,0 | | | 92,3 | | | |
| Morocco | 72,4 | | | 78,8 | | | |
| West Africa | | | | | | | |
| Nigeria | Cat: III. | | | 79,5 | | | |
| Central Africa | - | | | - | | | |
| East and Southern Africa | - | | | - | | | |
| 2. LATIN AMERICA | | | | | | | |
| Central America | - | | | - | | | |
| Caribbean | | | | | | | |
| Cuba | Cat: IV. | | | 80,1 | | | |
| South America | | | | | | | |
| Colombia | Cat: IV. | | | 75,9 | | | |
| 3. NEAR EAST | | | | | | | |
| N.E. Africa | - | | | - | | | |
| N.E. Asia | - | | | - | | | |

$P_2O_5$-CONSUMPTION, 1000 t $P_2O_5$
Category V

| Name | 1976/77 Total | 1976/77 From Total SSP | 1976/77 From Total TSP | 1981/82 Total | 1981/82 From Total SSP | 1981/82 From Total TSP | Notice |
|---|---|---|---|---|---|---|---|
| 4. FAR EAST | | | | | | | |
| South Asia | - | | | - | | | |
| East and South-East Asia | | | | | | | |
| Malaysia | Cat: IV. | | | 98,6 | | 2,3 | |
| Thailand | 80,3 | | | Cat: VI. | | | |
| Viet Nam | 95,0 | | | Cat: III. | | | |
| 5. OCEANIA | - | | | - | | | |

Appendix 4/1 Table 2/6

## $P_2O_5$ - C O N S U M P T I O N

1000 t $P_2O_5$

Category VI /over 100/

| Name | 1976/77 Total | 1976/77 From Total SSP | 1976/77 From Total TSP | 1981/82 Total | 1981/82 From Total SSP | 1981/82 From Total TSP | Notice |
|---|---|---|---|---|---|---|---|
| 1. AFRICA | | | | | | | |
| North-West Africa | - | | | - | | | |
| West Africa | - | | | - | | | |
| Central Africa | - | | | - | | | |
| East and Southern Africa | - | | | - | | | |
| 2. LATIN AMERICA | | | | | | | |
| Central America | | | | | | | |
| Mexico | 235,9 | 58,0 | 69,8 | 384,2 | 73,3 | 87,0 | |
| Caribbean | - | | | - | | | |
| South America | | | | | | | |
| Brazil | 1308,3 | 262,0 | 471,7 | 1312,7 | | | |
| 3. NEAR EAST | | | | | | | |
| N.E. Africa | | | | | | | |
| Egypt | Cat: IV. | | | 110,0 | 110,0 | | |
| N.E. Asia | | | | | | | |
| Iran | 161,5 | | | 289,4 | | | |
| Turkey | 521,9 | | | 495,3 | | | |
| 4. FAR EAST | | | | | | | |
| South Asia | | | | | | | |
| Bangladesh | Cat: IV. | | | 119,4 | | 95,9 | |
| India | 649,5 | 139,2 | 0,9 | 1172,1 | 187,0 | 20,9 | |
| Pakistan | 117,9 | 13,6 | 0,7 | 225,5 | 19,4 | | |

$P_2O_5$-CONSUMPTION, 1000 t $P_2O_5$
Category VI

| Name | 1976/77 | | | 1981/82 | | | Notice |
|---|---|---|---|---|---|---|---|
| | Total | From Total | | Total | From Total | | |
| | | SSP | TSP | | SSP | TSP | |
| East and South-East Asia | | | | | | | |
| China | 1491,0 | | | 2931,3 | | | |
| Indonesia | 111,4 | | | 320,4 | | 296,2 | |
| Korea DPR | 127,0 | | | 130,0 | | | |
| Korea Rep | 142,1 | | 14,1 | 137,8 | 2,2 | | |
| Thailand | Cat: V. | | | 126,2 | | | |
| 5. OCEANIA | - | | | - | | | |

Appendix 4/1

Table 3/1

## $K_2O$ - C O N S U M P T I O N

1000 t $K_2O$

Category I /less than 1000 t/

| Name | 1976/77 | 1981/82 | Notice |
|---|---|---|---|
| 1. AFRICA | | | |
| North-West Africa | - | - | |
| West Africa | | | |
| Gambia | 0,9 | 0,5 | |
| Guinea | 0,4 | Cat: II. | |
| Guinea Bissau | 0,1 | 0,04[1] | |
| Liberia | 0,4 | 0,7 | |
| Niger | 0,07 | 0,43[1] | |
| Mauritania | ... | 0,2[1] | |
| Sierra Leone | 0,22 | 0,73 | |
| Togo | 0,8 | 0,96 | |
| Upper Volta | 0,4 | Cat: II. | |
| Central Africa | | | |
| Angola | 0,5 | Cat: II. | |
| Centr. Afr. Rep. | 0,2 | 0,03 | |
| Congo | Cat: II. | 0,2 | |
| Gabon | 0,3 | 0,6 | |
| East and Southern Africa | | | |
| Burundi | 0,03 | 0,4 | |
| Djibouti | 0,7 | Cat: II. | |
| Ethiopia | ... | 0,2[1] | |
| Kenya | 0,4 | 0,7 | |
| Mozambique | Cat: II. | 0,9 | |
| Rwanda | 0,08 | 0,1 | |
| Uganda | 0,26 | ... | |

$K_2O$-CONSUMPTION, 1000 t $K_2O$
Category I

| Name | 1976/77 | 1981/82 | Notice |
|---|---|---|---|
| 2. LATIN AMERICA | | | |
| Central America | | | |
| Belize | ... | 0,4 | |
| Caribbean | | | |
| Bahamas | 0,5 | 0,3 | |
| Haiti | 0,1 | Cat: II. | |
| St. Lucia | o,8 | 0,1 | |
| St. Vincent | 0,1 | 1,0 | |
| South America | | | |
| Bolivia | 0,1 | 0,7 | |
| Fr. Guyana | - | 0,2 | |
| Paraguay | 0,2 | Cat: II. | |
| Suriname | 0,2 | 0,3 | |
| 3. NEAR EAST | | | |
| N.E. Africa | | | |
| Sudan | - | 0,2 | |
| N.E. Asia | | | |
| Afghanistan | - | 0,1 | |
| Iraq | ... | 0,1 | |
| Jordan | 0,8 | Cat: II. | |
| Kuwait | - | 0,1 | |
| Oman | 0,2 | 0,3 | |
| Saudi Arabia | 0,16 | Cat: II. | |
| Syria | 0,96 | Cat: II. | |
| U.A. Emirates | - | 0,33 | |
| Yemen AR | ... | 0,6 | |
| Yemen PDR | 0,05 | ... | |

$K_2O$-CONSUMPTION, 1000 t $K_2O$
Category I

| Name | 1976/77 | 1981/82 | Notice |
|---|---|---|---|
| 4. FAR EAST | | | |
| South Asia | | | |
| Nepal | Cat: II. | 0,6 | |
| Eat and South-East Asia | - | - | |
| 5. OCEANIA | | | |
| Fr. Polynesia | 0,2 | 0,3 | |
| New-Caledonia | 0,01 | 0,06 | |
| Samoa | ... | 0,15 | |

Appendix 4/1 Table 3/2

## $K_2O$ - C O N S U M P T I O N

1000 t $K_2O$

Category II /1-10/

| Name | 1976/77 | 1981/82 | Notice |
|---|---|---|---|
| 1. AFRICA | | | |
| North-West Africa | | | |
| Tunisia | 2,5 | 4,3 | |
| West Africa | | | |
| Benin | 1,0 | 1,9 | |
| Ghana | 3,3 | 8,0 | |
| Guinea | Cat. I. | 1,1 | |
| Mali | 3,1 | 3,5 | |
| Upper Volta | Cat: I. | 1,3 | |
| Central Africa | | | |
| Angola | Cat: I. | 2,7 | |
| Cameroon | 6,9 | Cat: III. | |
| Chad | 3,1 | 1,6 | |
| Congo | 2,5 | Cat: I. | |
| Zaire | 1,3 | 2,6 | |
| East and Southern Africa | | | |
| Djibouti | Cat: I. | 1,1 | |
| Madagascar | 4,1 | 2,1 | |
| Malawi | 4,8 | 3,2 | |
| Mauritius | Cat: III. | 9,95 | |
| Mozambique | 1,6 | Cat: I. | |
| Reunion | 3,5 | 4,8 | |
| Swaziland | 2,4 | 5,2 | |
| Tanzania | 6,4 | 3,1 | |
| Zambia | 6,1 | 6,7 | |

Table 3/2 /cont./

Category II /1-10/

| Name | 1976/77 | 1981/82 | Notice |
|---|---|---|---|
| 2. LATIN AMERICA | | | |
| Central America | | | |
| El Salvador | 8,7 | 1,8 | |
| Honduras | 5,4 | Cat: III. | |
| Panama | 7,5 | Cat: III. | |
| Caribbean | | | |
| Barbados | 1,7 | 3,0 | |
| Dominica | 2,3 | 1,4 | |
| Guadeloupe | 3,2 | 3,2 | |
| Haiti | Cat: I. | 1,4 | |
| Jamaica | 5,7 | 5,9 | |
| Martinique | 2,5 | 6,9 | |
| St. Kitts-Nevis | 1,2 | 1,3 | |
| South America | | | |
| Argentina | 4,2 | 5,3 | |
| Guyana | 1,8 | 4,7 | |
| Paraguay | Cat: I. | 2,1 | |
| Trinidad a. Tobago | 2,7 | 3,1 | |
| Uruguay | 4,0 | 3,5 | |
| 3. NEAR EAST | | | |
| N.E. Africa | | | |
| Egypt | 2,8 | Cat: III. | |
| Libya | 3,7 | 2,7 | |

$K_2O$-CONSUMPTION, 1000 t $K_2O$
Category II

| Name | 1976/77 | 1981/82 | Notice |
|---|---|---|---|
| N.E. Asia | | | |
| Cyprus | 3,1 | 1,4 | |
| Iran | 2,7 | ... | |
| Jordan | Cat: I. | 1,0 | |
| Lebanon | 2,4 | Cat: III. | |
| Saudi-Arabia | Cat: I. | 2,3 | |
| Syria | Cat: I. | 4,1 | |
| 4. FAR EAST | | | |
| South Asia | | | |
| Nepal | 1,4 | Cat: I. | |
| Pakistan | 2,4 | Cat: III. | |
| East and South-East Asia | | | |
| Burma | 1,5 | Cat: III. | |
| Kampuchea DM | ... | 1,0 | |
| Singapure | 1,0 | 2,2 | |
| 5. OCEANIA | | | |
| Fiji | 2,2 | 2,7 | |
| Papua New Guinea | 1,8 | 2,4 | |

Appendix 4/1 Table 3/3

## $K_2O$ - C O N S U M P T I O N

1000 t $K_2O$

Category III /10-40/

| Name | 1976/77 | 1981/82 | Notice |
|---|---|---|---|
| 1. AFRICA | | | |
| North-West Africa | | | |
| Algeria | 30,0 | 33,4 | |
| Morocco | 32,2 | 40,3 | |
| West Africa | | | |
| Ivory Coast | 19,0 | 29,0 | |
| Nigeria | 14,0 | 37,0 | |
| Senegal | 12,7 | 10,0 | |
| Central Africa | | | |
| Cameroon | Cat: II. | 10,2 | |
| East and Southern Africa | | | |
| Mauritius | 10,3 | Cat: II. | |
| Zimbabwe | 18,9 | 30,4 | |
| 2. LATIN AMERICA | | | |
| Central America | | | |
| Costa Rica | 16,8 | 17,0 | |
| Guatemala | 17,9 | 18,5 | |
| Honduras | Cat: II. | 10,1 | |
| Nicaragua | 11,0 | 13,8 | |
| Panama | Cat: II. | 10,0 | |
| Caribbean | | | |
| Dominican Rep | 19,4 | 15,8 | |

$K_2O$-CONSUMPTION, 1000 t $K_2O$
Category III

| Name | 1976/77 | 1981/82 | Notice |
|---|---|---|---|
| South America | | | |
| Chile | 13,2 | 11,0 | |
| Colombia | 34,5 | Cat: IV. | |
| Ecuador | 18,6 | 18,1 | |
| Peru | 11,6 | 12,8 | |
| Venezuela | 39,9 | 30,3 | |
| 3. NEAR EAST | | | |
| N.E. Africa | | | |
| Egypt | Cat: II. | 12,9 | |
| N.E. Asia | | | |
| Lebanon | Cat: II. | 10,3 | |
| Turkey | 28,9 | 22,0 | |
| 4. FAR EAST | | | |
| South Asia | | | |
| Bangladesh | 14,5 | 28,1 | |
| Pakistan | Cat: II. | 21,8 | |
| Sri Lanka | 28,5 | Cat: IV. | |
| East and South-East Asia | | | |
| Burma | Cat: II. | 11,0 | |
| Indonesia | 30,0 | Cat: VI. | |
| Korea DPR | 37,7 | Cat: V. | |
| Thailand | 20,5 | 35,6 | |
| Viet Nam | 34,2 | 22,1 | |
| 5. OCEANIA | - | - | |

Appendix 4/1 Table 3/4

## $K_2O$ - C O N S U M P T I O N

1000 t $K_2O$

Category IV /40-70/

| Name | 1976/77 | 1981/82 | Notice |
|---|---|---|---|
| 1. AFRICA | | | |
| North-West Africa | - | - | |
| West Africa | - | - | |
| Central Africa | - | - | |
| East and Southern Africa | - | - | |
| 2. LATIN AMERICA | | | |
| Central America | | | |
| Mexico | 54,0 | 65,1 | |
| Caribbean | - | - | |
| South America | | | |
| Colombia | Cat: III. | 70,0 | |
| 3. NEAR EAST | | | |
| N.E. Arrica | - | - | |
| N.E. Asia | - | - | |
| 4.FAR EAST | | | |
| South Asia | | | |
| Sri Lanka | Cat: III. | 47,0 | |
| East and South-East Asia | | | |
| Philippines | 51,5 | 60,7 | |
| 5. OCEANIA | - | - | |

Appendix 4/1 Table 3/5

## $K_2O$ - C O N S U M P T I O N

1000 t $K_2O$

Category V /70-100/

| Name | 1976/77 | 1981/82 | Notice |
|---|---|---|---|
| 1. AFRICA | | | |
| North-West Africa | - | - | |
| West Africa | - | - | |
| Central Africa | - | - | |
| East and Southern Africa | - | - | |
| 2. LATIN AMERICA | | | |
| Central America | - | - | |
| Caribbean | - | - | |
| South America | - | - | |
| 3. NEAR EAST | | | |
| N.E. Africa | - | - | |
| N.E. Asia | - | - | |
| 4. FAR EAST | | | |
| South Asia | - | - | |
| East and South-East Asia | | | |
| Korea DPR | Cat: III. | 92,0 | |
| 5. OCEANIA | - | - | |

Appendix 4/1 Table 3/6

## $K_2O$ - C O N S U M P T I O N

1000 t $K_2O$

Category VI /over 100/

| Name | 1976/77 | 1981/82 | Notice |
|---|---|---|---|
| 1. AFRICA | | | |
| North-West Africa | - | - | |
| West Africa | - | - | |
| Central Africa | - | - | |
| East and Southern Africa | - | - | |
| 2. LATIN AMERICA | | | |
| Central America | - | - | |
| Caribbean | | | |
| Cuba | 115,9 | 213,6 | |
| South America | | | |
| Brazil | 721,5 | 766,6 | |
| 3. NEAR EAST | | | |
| N.E. Africa | - | - | |
| N.E. Asia | - | - | |
| 4. FAR East | | | |
| South Asia | | | |
| India | 377,3 | 670,4 | |
| East and South-East Asia | | | |
| China | 174,0 | 681,1 | |
| Indonesia | Cat: III. | 136,2 | |
| Korea Rep | 139,8 | 199,1 | |
| Malaysia | 141,1 | 173,6 | |
| 5. OCEANIA | - | - | |

Table 1

Countries according to their annual consumption of fertilizers

| Consumption rates, tonnes of nutrient | Nitrogenous | | | | | Phosphate | | | | | Potassium | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1980/81 | | 1986/87 | | | 11980/81 | | 1986/87 | | | 1980/81 | | 1986/87 | | |
| | No | % | No | % | % | No | % | No | % | % | No | % | No | % | % |
| Up to 10.000 | 40 | 43 | 29 | 31 | -12 | 50 | 54 | 42 | 46 | -8 | 62 | 67 | 56 | 61 | -6 |
| 10.000-30.000 | 16 | 17 | 18 | 20 | +3 | 12 | 13 | 15 | 16 | +3 | 14 | 15 | 15 | 16 | +1 |
| 30.000-60.000 | 9 | 10 | 12 | 13 | +3 | 11 | 12 | 12 | 13 | +1 | 7 | 8 | 9 | 10 | +2 |
| 60.000-100.000 | 8 | 9 | 8 | 8 | 0 | 6 | 7 | 8 | 9 | +2 | 4 | 4 | 5 | 5 | +1 |
| Over 100.000 | 19 | 21 | 25 | 27 | +6 | 13 | 14 | 15 | 16 | +2 | 5 | 6 | 7 | 8 | +2 |

Table 2

## Countries according to their per hectare consumption of fertilizers

| Consumption rates, tonnes of nutrient | Nitrogenous | | | | | Phosphate | | | | | Potassium | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1980/81 | | 1986/87x | | | 1980/81 | | 1986/87x | | | 1980/81 | | 1986/87x | | |
| | No | % | No | % | % | No | % | No | % | % | No | % | No | % | % |
| Up to 10.000 | 47 | 51 | 43 | 47 | -4 | 59 | 64 | 49 | 53 | 11 | 74 | 80 | 72 | 78 | -2 |
| 10.000-30.000 | 28 | 30 | 20 | 22 | -8 | 30 | 33 | 28 | 30 | -3 | 13 | 13 | 13 | 14 | +1 |
| 30.000-60.000 | 10 | 19 | 18 | 20 | +9 | 2 | 2 | 11 | 12 | +10 | 3 | 4 | 5 | 5 | +1 |
| Over 60.000 | 7 | 8 | 11 | 11 | +3 | 1 | 1 | 4 | 5 | +4 | 2 | 3 | 2 | 3 | 0 |

x/ Consumption of nutrient per hectare has been calculated dividing the forecasted demand in 1986/87 by arable and permanent crop area in 1980/81.

Appendix 4/3 - Raw material potential in developing countries — Table 1

## Production of natural gas and reserves in the developing countries

$10^9$ cu m

| Country | Production a./ 1982 | Reserves c./ 1982 |
|---|---|---|
| 1. AFRICA | | |
| North-West Africa | | |
| Algeria | 23,46 | 3150 |
| Morocco | 0,10 | 1 d./ |
| Tunisia | 0,44 | 122 |
| West Africa | | |
| Nigeria | 1,94 | 918 |
| Central Africa | | |
| Angola | 0,24 | 42 |
| Cameroon | | 126 |
| Congo | | 76 |
| Gabon | 0,14 | 14 |
| Zaire | | 1 |
| East and Southern Africa | | |
| Tanzania | - | 6 |

Appendix 4/3

Table 1 /cont'd/
$10^9$cu m

| Country | Production a./ 1982 | Reserves c./ 1982 |
|---|---|---|
| Central America | | |
| Mexico | 43,89 | 2148 |
| South America | | |
| Argentina | 10,94 | 714 |
| Bolivia | 2,79 | 160 |
| Brazil | 3,02 | 66 |
| Chile | 5,05 | 70 |
| Colombia | 2,96 | 130 |
| Ecuador | 0,05 | 116 |
| Peru | 0,95 | 34 |
| Venezuela | 14,93 | 1532 |
| Trinidad and Tobago | 2,41 | 312 |
| 3. NEAR EAST | | |
| N.E. Africa | | |
| Egypt | 2,45 | 203 |
| Libya | 4,34 | 609 |
| Sudan | | 1 d./ |
| N.E. Asia | | |
| Afghanistan | 4,49 | 54 e./ |
| Bahrain | 5,07 | 223 |
| Iran | 10,80 | 13.667 |

Appendix 4/3

Table 1 /cont'd/

$10^9$ cu m

| Country | Production a./ 1982 | Reserves c./ 1982 |
|---|---|---|
| Iraq | 0,65 | 816 |
| Kuwait | 3,79 | 847 |
| Oman | 2,14 | 76 |
| Qatar | 3,64 | 1756 |
| Saudi-Arabia | 16,73 | 3313 |
| Syria | 0,24 | 36 |
| Turkey | 0,10 | 15 e./ |
| U.A. Emirates | 13,44 b./ | 810 |
| 4. FAR EAST | | |
| South Asia | | |
| Bangladesh | 1,03 b./ | 198 |
| India | 2,31 | 411 |
| Pakistan | 8,93 | 525 |
| East and South-East Asia | | |
| Burma | 0,48 | 5 |
| China | 10,31 | 844 |
| Indonesia | 16,11 | 838 |
| Malaysia and Brunei | 10,74 | 1155 |
| Thailand | | 312 |

a./ Unless indicated otherwise data taken from International Petroleum Encyclopedia 1983, Pennwell Publishing Co., Box 1260, Tulsa, Oklahoma 74101, 1983. p. 318.

b./ Statistics Review 1983, Energy Economics Research Ltd. 6. May 1983. pp. 8-9.

c./ Unless indicated otherwise data taken from International Petroleum Encyclopedia 1983, ep.cit.

d./ Proven reserves as of 1. January 1981. Petroleum Economist, August 1981.

e./ Statistics Review 1983, Energy Economics Research Ltd, 6. May 1983. pp. 4-5.

Appendix 4/3 Table 2

## Crude oil production, reserves and refining capacities in the developing countries

$10^6$ t

| Country | Production a 1982 | Reserves a 1982 | Refining capacity a 1982 |
|---|---|---|---|
| 1. AFRICA | | | |
| North-West Africa | | | |
| Algeria | 37,50 | 850 | 4,6 |
| Morocco | 0,01 | small[c] | 3,7 |
| Tunisia | 5,30 | 167 | 1,7 |
| West Africa | | | |
| Gambia | | exploration under constr[c] | |
| Ghana | 0,08 | small | 1,3 |
| Guinea | | | available[c] |
| Ivory Coast | 0,45 | 10 | 4,5 |
| Mali | | discovery[c] | |
| Mauritania | | discoveries probable[c] | |
| Nigeria | 66,20 | 1508 | 13,0 |
| Senegal | | 100 | 0,9 |
| Sierra Leone | | | 0,5 |
| Central Africa | | | |
| Angola | 6,10 | 147 | 1,6 |
| Cameroon | 5,45 | 48 | 2,2 |
| Chad | | 20 | small planed[c] |
| Congo | 4,35 | 140 | ... |
| Gabon | 6,50 | 41 | 1,0 |
| Zaire | 1,10 | 13 | 0,9 |

Appendix 4/3

Table 2 /cont'd/

$10^6$ t

| Country | Production a 1982 | Reserves a 1982 | Refining capacity a 1982 |
|---|---|---|---|
| East and Southern Africa | | | |
| Ethiopia | | unidentified[c] | 0,7 |
| Kenya | | | 4,0 |
| Madagascar | | shale available[c] | 0,8 |
| Mozambique | | | 0,8 |
| Somalia | | available[c] | |
| Tanzania | | | 0,9 |
| Zambia | | | 1,2 |
| Zimbabwe | | available[c] | |
| 2. LATIN AMERICA | | | |
| Costa Rica | | | 0,8 |
| El Salvador | | | 0,8 |
| Guatemala | 0,32 | 4,0 | 0,8 |
| Honduras | | | 0,7 |
| Mexico | 136,7 | 4347 | 64,5 |
| Nicaraqua | | | 0,7 |
| Panama | | exploration[c] | 5,0 |
| Caribbean | | | |
| Barbados | 0,03 | small | 0,2 |
| Cuba | 0,36[b./] | | |
| Dominican Rep | | | 2,4 |
| Jamaica | | | 1,8 |

Appendix 4/3

Table 2 /cont'd/

$10^6$ t

| Country | Production a 1982 | Reserves a 1982 | Refining capacity a 1982 |
|---|---|---|---|
| South America | | | |
| Argentina | 24,15 | 233 | 33,8 |
| Bolivia | 1,20 | 16 | 3,0 |
| Brazil | 12,60 | 158 | 61,0 |
| Chile | 2,05 | 68 | 7,0 |
| Colombia | 7,00 | 48 | 10,7 |
| Ecuador | 10,75 | 126 | 4,0 |
| Paraguay | | | 0,4 |
| Peru | 9,90 | 75 | 8,4 |
| Uruguay | | | 2,3 |
| Venezuela | 91,30 | 1935 | 64,2 |
| Trinidad a. Tobago | 9,10 | 52 | 18,8 |
| 3. NEAR EAST | | | |
| N.E. Africa | | | |
| Egypt | 33,35 | 300 | 17,0 |
| Libya | 56,35 | 1935 | 6,5 |
| Sudan | | 36 | 1,2 |
| N.E. Asia | | | |
| Bahrain | 2,25 | 18 | 12,5 |
| Iran | 94,80 | 4978 | 26,5 |
| Iraq | 45,70 | 3690 | 8,4 |
| Kuwait | 33,75 | 5780 | 31,2 |
| Lebanon | | | 2,6 |
| Oman | 16,40 | 246 | 2,3 |
| Qatar | 17,00 | 308 | 0,59 |
| Saudi-Arabia | 324,20 | 14616 | 35,3 |

Appendix 4/3

Table 2 /cont'd/

$10^6$ t

| Country | Production a 1982 | Reserves a 1982 | Refining capacity a 1982 |
|---|---|---|---|
| Syria | 8,75 | 137 | 11,4 |
| Turkey | 2,25 | 25 | 23,4 |
| U.A. Emirates | 62,35 | 2912 | 6,8 |
| Yemen PDR | | naphtha and refinery gases available[c] | 8,9 |
| **4. FAR EAST** | | | |
| Bangladesh | | | 1,6 |
| India | 19,20 | 307 | 37,6 |
| Pakistan | 0,60 | 18 | 6,7 |
| **East and South-East Asia** | | | |
| Burma | 1,50 | 3 | 1,3 |
| China | 101,00 | 1754 | 100,0 |
| Indonesia | 67,05 | 860 | 17,1 |
| Korea Rep | | | 37,7 |
| Malaysia-Brunei--Singapore | 23,05 | 141 | 8,8 |
| Philippines | 0,35 | 3 | 14,3 |
| Thailand | 0,30 | 9 | 8,8 |

a - Unless indicated otherwise data taken from International Petroleum Encyclopedia 1983, Pennwell Publishing Co; Box 1260, Tulsa, Oklahoma 74101.

b - Petroleum Economist, January 1983.

c - Fertilizers in developing countries, potential for setting up mini-fertilizer plants, Draft III/July 1982/ E.Z. Unido.

Appendix 4/3 Table 3

## Coal[a] production and reserves in the developing countries

$10^6$ t

| Country | Production 1981 | Known economic | Additional | Total |
|---|---|---|---|---|
| | c | d | d | d |
| 1. AFRICA | | | | |
| North-West africa | | | | |
| Morocco | 0,059 | ... | 90 | 40 /1979/ |
| West Africa | | | | |
| Benin | | | | lignite[b./] |
| Nigeria | 0,014 | 338 | 24 | 362 /1979/ |
| Sierra Leone | | | | lignite[b./] |
| Mali | | | 3 | 3 /1979/ |
| Central Africa | | | | |
| Angola | | | | 38[b./] |
| Cameroon | | | | 50[b./] |
| Zaire | | | | 1180[b./] |
| East and Southern Africa | | | | |
| Botswana | 0,032 | | | 500[b./] |
| Ethiopia | | | 1 | 1 /1966/ |
| Madagascar | | 75/1977/ | ... | 400[b./] |
| Malawi | | | | 50[b./] |
| Mozambique | 0,038 | 100 | 300 | 400 /1969/ |
| Tanzania | | | | 250[b./] |
| Zambia | 0,042 | | | 228[b./] |
| Zimbabwe | 0,231 | 965/1977/ | | |

Appendix 4/3

Table 3 /cont'd/

$10^6$ t

| Country | Production 1981 c | Known economic d | Additional d | Total d |
|---|---|---|---|---|
| 2. LATIN AMERICA | | | | |
| Central America | | | | |
| Honduras | | 21/1979/ | | |
| Mexico | | 480 | 500 | 980/1979/ |
| Caribbean | | | | |
| Haiti | | 13 | 27 | 40/1979/ |
| South America | | | | |
| Argentina | 0,042 | 150 | 9750 | 9900/1978/ |
| Brazil | 0,474 | 1320 | 12770 | 14090/1978/ |
| Chile | 0,063 | 1150 | 4135 | 5385/1979/ |
| Colombia | | 48 | 790 | 838/1979/ |
| Ecuador | | | 36 | 36/1979/ |
| Peru | | | 100 /1979/ | |
| Venezuela | 0,004 | 17 | 4300 | 4317/1979/ |
| 3. NEAR EAST | | | | |
| N.E. Asia | | | | |
| Jemen | | 1 | ... | 1 |
| Turkey | 1,467 | 3923 | 280 | 4203/1978/ |
| 4./ FAR EAST | | | | |
| South Asia | | | | |
| Bangladesh | | | 3 | 3/1979/ |
| India | 10,756 | 1869 | 281 | 2150/1978/ |
| Pakistan | 0,133 | 646/1972/ | ... | ... |

APPENDIX 4/3

Table 3 /cont'd/

$10^6$ t

| Country | Production 1981 c | Known economic d | Additional d | Total d |
|---|---|---|---|---|
| 5. EAST and SOUTH-EAST ASIA | | | | |
| Burma | | ... | 80/1975/ | ... |
| China | | ... | 40500 | ... |
| Indonesia | 0,040 | 661 | 18209 | 18870/1979/ |
| Korea Rep | 1,532 | | | |
| Korea DPR | | 300 | 2200 | 2500 |
| Malaysia | | | 250 | 250/1978/ |
| Viet Nam | | 12/1965/ | ... | ... |
| Thailand | 0,164 | 246/1978/ | ... | ... |
| Philippines | | 170/1979/ | ... | ... |

a./ The fiqures relate to all grades of anthracite, bituminous coal, brown coal and lignite.

b./ Source: Fertilizers in developing countries; potential for setting up mini-fertilizerplants.
Draft III. /July 1982/ E.Z. UNIDO

c./ Monthly Bulletin of Statistics, Vol. XXXVII N° 8, Aug. 1983. United Nations, New York.

d./ 1980 Yearbook of World Energy Statistics, United Nations, New York, 1981.

Appendix 4/3 Table 4

Production of phosphate rock and reserves in the developing countries

| Country | Production[a] $10^3$ t $P_2O_5$ | Total reserves $10^6$ t /% $P_2O_5$/ | | |
|---|---|---|---|---|
| | 1982 | c | d | f |
| 1. AFRICA | | | | |
| North-West Africa | | | | |
| Algeria | 294 | 1000/30%[e]/ | 525/32%/ | 1200 |
| Morocco | 5680 | 40000/30%[e]/ | 42000 | |
| Tunisia | 1213 | 1300/30%/ | 770 | 1500 |
| West Africa | | | | |
| Benin | | | 30/28%/ | |
| Liberia | | 1,5/28%/ | | |
| Mali | | 20/30%/ | 5 | |
| Mauritania | | 5/23-32%/ | | |
| Niger | | | small | |
| Nigeria | | | not fully estimated | |
| Segenal | 351 | 3200/30%[e]/ | 337/25-28%/ | |
| Togo | 739 | 300/30%[e]/ | 130 | |
| Upper Volta | | 4/27-31%/ | 34/29%/ | |
| Central Africa | | | | |
| Angola | | 120/30%[e]/ | 100/10-32%/ | |
| Centr.Afr.Rep. | | | 6,6/25%/ | |
| Congo | | | unidentified | |
| Zaire | | 83/15%/ | 83 | |
| East and Southern Africa | | | | |
| Burundi | | | 150/3-22%/ | |
| Malawi | | | 1,25/15%/ | |
| Tanzania | | 10/27-38%/ | 10/20%/ | |
| Uganda | | 200 | 220/13%/ | |
| Zimbabwe | 42 | 20/30%[e]/ | 37 | |

Appendix 4/3 Table 4 /cont'd/

| Country | Production $10^3$ t $P_2O_5$ 1982 | Total reserves $10^6$ t /% $P_2O_5$/ c | d | f |
|---|---|---|---|---|
| 2. LATIN AMERICA | | | | |
| Central America | | | | |
| Mexico | 125 | 1140/30%[e]/ | | |
| Nicaragua | | | found | |
| Caribbean | - | - | - | - |
| South America | | | | |
| Argentina | | | low grade | |
| Brazil | 946 | 1745/30%[e]/ | | 1600 |
| Chile | | 4/30%[e]/ | | |
| Colombia | 4 | 600/30%[e]/ | | |
| Peru | 9 | 6100/30%[e]/ | | 1502 |
| Venezuela | | 40/30%[e]/ | 20 | |
| 3. NEAR EAST | | | | |
| N.E. Africa | | | | |
| Egypt | 197 | 2800/30%[e]/ | 1350 | 4700 |
| N.E. Asia | | | | |
| Iran | | 130/30%[e]/ | | |
| Iraq | 80 | 660/30%[e]/ | | |
| Jordan | 1273[b] | 1000/15-30%/ | | |
| Lebanon | | small /17-31%/ | | |
| Saudi-Arabia | | 1000/30%[e]/ | | |
| Syria | 592 | 800/30%[e]/ | | 980 |
| Turkey | 8 | 300/30%[e]/ | | |

Appendix 4/3

Table 4 /cont'd/

| Country | Production $10^3$ t $P_2O_5$ | Total reserves $10^6$ t /% $P_2O_5$/ | | |
|---|---|---|---|---|
| | 1982 | c | d | f |
| South Asia | | | | |
| India | 175 | 140/17,5%/ | | 55 |
| Pakistan | | 12/20-37%/ | | |
| Sri Lanka | 5 | 300/30%/ | | |
| East and South-East Asia | | | | |
| China | 3125 | 30000/15%/ | | |
| Korea DPR | 160 | 88/12,5%/ | | |
| Mongolia | | 1000/20-22%/ | 400 | |
| Thailand | | | findings | |
| Viet Nam | 175 | 500/30%[e]/ | | |

a - Phosphate Rock Statistics 1982, International Fertilizer Industry Association Limited, 28, rue Marbeuf, 75008 Paris.

b - World Phosphate Rock Statistics 1981.
Phosphorus and Potassium No. 120. July/August 1982.
/Data calculated from tel-quel weight, assuming 30% $P_2O_5$/

c - Fertilizer Manual
Development and Transfer of Technology Series No.12., UNIDO

d - Fertilizers in developing countries; potential for setting up minifertilizer plants.

e - Tonnage and grade stated in terms of equivalent quantity of marketable phosphate rock of 30% $P_2O_5$ grade or higher.

f - World Survey of Phosphate Deposits, 1980, The British Sulphur Corporation Limited, Parnell House, 25 Wilton Road, London.

Appendix 4/3

Table 5

Production of potash and reserves in the developing countries

| Country | Production[a] in 1981/82 1000 t $K_2O$ |
|---|---|
| China | 24,4 /FAO estimate/ |
| Chile | 26,6 |
| Congo | /the mine were closed down in 1977 due to a floading/ |

| Country | Reserves[b] $10^6$ t | Plans[b] |
|---|---|---|
| Algeria | limited | no |
| Congo | redevelop the operation at the closed mine; | |
| | 30 /carnallite/ | no |
| Ethiopia | 60 /$K_2O$/ | start 1983-89 |
| Libya | 0,65 /$K_2O$/ | no |
| Morocco | 200 /carnallite/ | |
| | 40 /sylvinite/ | |
| Tunisia | 24 /$K_2O$/ | projected capacity by 1986 140 000 tpa KCl |
| China | 200 /KCl/ | current capacity about 20 000 tpa $K_2O$; projected capacity--expansion: in the first phase: 200 000 tpa in the second phase: $1,0.10^6$ tpa /late in the 1980s/ |
| India | n.a. | studies |
| Iran | 60 /$K_2O$/ | n.a. |

Appendix 4/3 Table 5 /cont'd/

| Country | Reserves[b] $10^6$ t | Plans[b] |
|---|---|---|
| Jordan | 2000 /$K_2O$/ | initial capacity: 240 000 tpa KCl total capacity /by 1985/: 1,2.$10^6$ tpa |
| Pakistan | large | no |
| Thailand | large | projected capacity by 1990: 7.$10^6$ tpa KCl |
| Brazil | 525 /sylvinite/ 6350 /carnallite/ | projected capacity by 1984: 500 000 tpa KCl; doubled by 1990 |
| Chile | n.a. | current capacity about 24 000 tpa $K_2O$ |
| Mexico | n.a. | projected capacity by 1984: 80 000 tpa KCl; doubled by 1990 |
| Peru | n.a. | projected initial capacity by 1990: 100 000 - 200 000 tpa KCl |

a - FAO Statistics

b - "The situation of the potash industry in the developing countries" by Fernand C. Angulo, UNIDO; presented at Lahore, Pakistan 1982

n.a. - not available

Appendix 4/3 Table 6

## Production of Sulphur in-all-forms and reserves in the developing countries in 1981

1000 t S/S equivalent

| Country | Brimstone | | Pyrites | Other forms | Total | Reserves b,c |
|---|---|---|---|---|---|---|
| | total | from wich sulphur recovered | | | | |
| 1. AFRICA | | | | | | |
| North-West Africa | | | | | | |
| Algeria[a] | 15 | 15 | - | - | 15 | 0 |
| Morocco[a] | - | - | 38 | - | 38 | 0 |
| Central Africa | | | | | | |
| Angola | - | - | - | - | - | + |
| Zaire[a] | - | - | - | 30 | 30 | |
| East and Southern Africa | | | | | | |
| Ethiopia | - | - | - | - | - | + |
| Kenya | - | - | - | - | - | 0 |
| Madagascar | - | - | - | - | - | 0 |
| Malawi | - | - | - | - | - | 0 |
| Tanzania | - | - | - | - | - | 0 |
| Zambia[d] | - | - | - | 80 | - | 0 |
| Zimbabwe[a] | - | - | 25 | 5 | 30 | |
| 2. LATIN AMERICA | | | | | | |
| Central America | | | | | | |
| Costa Rica | - | - | - | - | - | + |
| Guatemala | - | - | - | - | - | + |
| Mexico[d] | 1971 | - | - | 105 | 1896 | +0 |

Appendix 4/3 Table 6 /cont'd/

| Country | Brimstone | | Pyrites | Other forms | Total | Reserves b,c |
|---|---|---|---|---|---|---|
| | total | from wich sulphur recovered | | | | |
| Caribbean | | | | | | |
| Bahamas[a] | 5 | 5 | - | - | - | |
| Cuba[a] | 8 | 8 | 2 | - | 10 | |
| South America | | | | | | |
| Argentina[e] | 5,8 | 5,8 | - | - | 5,8 | +0 |
| Bolivia[a] | 11,0 | - | - | - | 11,0 | +0 |
| Brazil[a] | 150,0 | 150,0 | - | - | 150,0 | 0 |
| Chile[d] | 75 | ... | - | 32 | 107,0 | + |
| Colombia[e] | 16,8 | 16,8 | - | - | 16,8 | +0 |
| Ecuador[a] | 14,0 | 10 | - | - | 14,0 | + |
| Peru | 20 | 20 | - | - | 20 | +0 |
| Trinidad and Tobago[e] | 12,8 | 12,8 | - | - | 12,8 | |
| Uruguay[a] | 2,0 | 2,0 | - | - | 2,0 | |
| Venezuela | 90,0[d] | 68,3[e] | - | - | 90,0[d] | +0 |
| 3. NEAR EAST | | | | | | |
| N.E. Africa | | | | | | |
| Egypt[a] | 20,0 | 20,0 | - | - | 20,0 | + |
| Libya[a] | 16,0 | 16,0 | - | - | 16,0 | |
| N.E. Asia | | | | | | |
| Afghanistan[d] | - | - | - | - | - | + |
| Bahrain[a] | 36 | 36 | - | - | 36 | |
| Cyprus[a] | - | - | 20 | - | 20 | 0 |
| Iran[a] | 150 | 100 | - | - | 150 | + |
| Iraq[d] | 200 | ... | - | - | 200 | + |

Appendix 4/3 Table 6 /cont'd/

| Country | Brimstone | | Pyrites | Other forms | Total | Reserves b,c |
|---|---|---|---|---|---|---|
| | total | from wich sulphur recovered | | | | |
| Jordan[a] | - | - | - | - | - | + |
| Kuwait | 118[d] | 116,8[e] | - | - | 118[d] | |
| Saudi-Arabia[e] | 671,6 | 671,6 | - | - | 671,6 | 0 |
| Syria[a] | 8,0 | 8,0 | - | - | 8,0 | |
| Turkey[a] | 30,0 | ... | 24,0 | 65,0 | 119,0 | +0 |
| 4. FAR EAST | | | | | | |
| South Asia | | | | | | |
| India[d] | 5 | ... | 20 | 80 | 105 | +0 |
| Nepal | - | - | - | - | - | 0 |
| Pakistan[a] | small | - | - | 15 | 15 | + |
| East and South--East Asia | | | | | | |
| Burma | - | - | - | - | - | 0 |
| China[d] | 200 | - | 2100 | 75 | 2375 | |
| Indonesia[a] | small | - | - | - | - | +0 |
| Korea DPR[a] | - | - | 255 | 10 | 265 | |
| Korea Rep. | 36[a] | 9,9[e] | small[a] | 54[a] | 90[a] | 0 |
| Philippines[d] | - | - | 37 | - | 37 | +0 |
| Singapore[a] | 25 | 25 | - | - | 25 | |
| Thailand | - | - | - | - | - | +0 |

a - Bureau of mines minerals yearbook, 1981. US Department of the Interior

b - Mineralnüe reszurszü promüslenno razvitüh kapitaliszticseszkih i rajzvivajuscsihszja sztran 1978. Moszkva, 1979. Szojuzgeolfond, 444 p.

Appendix 4/3 Table 6 /cont'd/

c - Opportunities for the establishment of mini fertilizer plants in the developing countries. Sectorial Studies Branch, UNIDO 1983.

d - Preliminary Sulphur and Sulphuric Acid Statistics 1982, May 1983, pp. 1-2.
The British Sulpur Corporation Limited, London.

e - Oil and Gas Journal, 8 August 1983, pp. 114-118.

Brimstone: includes Frasch, native and byproducts based on petroleum and naturalgas.

Other forms: When data of sulphur recovered are available it includes byproducts based on coal and metallurgy;
When data of sulphur recovered are not available it includes byproducts based on coal, metallurgy, petroleum and natural gas.

Reserves: + - Sulphur
O - Pyrite

Appendix 4/3 Table 7

## Raw materials potential for fertilizer production in developing countries studied /1983/

| Country | Natural gas | Crude oil | Coal, lignite hydropotential | Phosphate rock | Potash |
|---|---|---|---|---|---|
| 1. AFRICA | | | | | |
| North-West Africa | | | | | |
| Algeria | + | + | - | + | - |
| Morocco | + | + | + | + | + |
| Tunisia | + | + | - | + | + |
| West Africa | | | | | |
| Benin | - | - | + | + | - |
| Gambia | - | +/?/ | - | - | - |
| Ghana | - | + | - | - | - |
| Guinea | - | /?/ | - | - | - |
| Ivory Coast | - | + | - | - | - |
| Mali | - | +/?/ | + | +/?/ | - |
| Mauritania | - | +/?/ | - | - | - |
| Niger | - | - | - | + | - |
| Nigeria | + | + | + | + | - |
| Senegal | - | + | - | + | - |
| Sierra Leone | - | /?/ | + | - | - |
| Togo | - | - | - | + | - |
| Central Africa | | | | | |
| Angola | + | + | + | + | - |
| Cameroon | + | + | + | - | - |
| Centr. Afr. Rep. | - | - | - | + | - |

Appendix 4/3 Table 7 /cont'd/

| Country | Natural gas | Crude oil | Coal, lignite hydropotential | Phosphate rock | Potash |
|---|---|---|---|---|---|
| Chad | - | +/?/ | - | - | - |
| Congo | + | + | - | + | + |
| Gabon | + | + | - | - | - |
| Zaire | + | + | + | + | - |
| East and Southern Africa | | | | | |
| Botswana | - | - | + | - | - |
| Burundi | - | - | - | + | - |
| Ethiopia | - | +/?/ | + | - | + |
| Kenya | - | /?/ | - | - | + |
| Madagascar | - | +/?/ | + | - | - |
| Malawi | - | - | + | + | - |
| Mozambique | - | /?/ | + | - | - |
| Somalia | - | /?/ | - | - | - |
| Tanzania | + | /?/ | + | + | - |
| Uganda | - | - | - | + | - |
| Zambia | - | /?/ | + | + | - |
| Zimbabwe | - | /?/ | + | + | - |
| 2. LATIN AMERICA | | | | | |
| Central America | | | | | |
| Costa Rica | - | /?/ | - | - | - |
| El Salvador | - | /?/ | - | - | - |
| Guatemala | - | + | - | - | - |
| Honduras | - | /?/ | + | - | - |
| Mexico | + | + | + | + | + |
| Nicaragua | - | /?/ | - | - | - |
| Panama | - | +/?/ | - | +/?/ | - |

Appendix 4/3 Table 7 /cont'd/

| Country | Natural gas | Crude oil | Coal, lignite hydropotential | Phosphate rock | Potash |
|---|---|---|---|---|---|
| Caribbean | | | | | |
| Cuba | - | +/?/ | - | - | - |
| Dominican Rep. | - | /?/ | - | - | - |
| Haiti | - | - | + | - | - |
| Jamaica | - | /?/ | - | - | - |
| South America | | | | | |
| Argentina | + | + | + | +/?/ | - |
| Bolivia | + | + | - | +/?/ | - |
| Brazil | + | + | + | + | + |
| Chile | + | + | + | - | + |
| Colombia | + | + | + | + | - |
| Ecuador | + | + | + | - | - |
| Paraguay | - | /?/ | - | - | + |
| Peru | + | + | + | + | + |
| Trinidad and Tobago | + | + | - | - | - |
| Uruguay | - | /?/ | - | - | - |
| Venezuela | + | + | + | + | - |
| 3. NEAR EAST | | | | | |
| N.E. Africa | | | | | |
| Egypt | + | + | - | + | - |
| Libya | + | + | - | - | - |
| Sudan | + | + | - | - | - |
| N.E. Asia | | | | | |
| Afghanistan | + | - | - | + | - |
| Iran | + | + | - | - | + |
| Iraq | + | + | - | + | + |
| Jordan | - | - | - | + | + |
| Lebanon | - | /?/ | - | - | - |

Appendix 4/3 Table 7 /cont'd/

| Country | Natural gas | Crude oil | Coal, lignite hydropotential | Phosphate rock | Potash |
|---|---|---|---|---|---|
| Saudi-Arabia | + | + | - | +/?/ | - |
| Syria | + | + | - | + | - |
| Turkey | + | + | + | +/?/ | - |
| Yemen PDR | + | +/?/ | + | - | - |
| 4. FAR EAST | | | | | |
| South Asia | | | | | |
| Bangladesh | + | /?/ | + | - | - |
| India | + | + | + | + | - |
| Pakistan | + | + | + | - | + |
| Sri Lanka | - | - | - | + | - |
| East and South-East Asia | | | | | |
| Burma | + | + | + | - | - |
| China | + | + | + | + | + |
| Indonesia | + | + | + | + | - |
| Korea DPR | - | - | + | + | - |
| Korea Rep. | - | /?/ | + | - | - |
| Malaysia | + | + | + | - | - |
| Philippines | + | + | + | - | - |
| Thailand | + | + | + | + | + |
| Viet Nam | - | - | + | + | - |
| Number of countries: 81 | 39 | 28 | 40 | 41 | 16 |

\+ : available

\- : not available

+/?/ : may be available

/?/: no oil reserves identified, refining capacity may be available

Appendix 4/4

Potential users of mini N fertilizer plants

/demand versus mini-plants capacities in countries identified as potential users of mini fertilizer plants/

Table 1

1000 tpy N

| | 1990 | | | 2000 | | |
|---|---|---|---|---|---|---|
| | Capacity of mini-plants[a] | Demand | Balance | Total capacity of mini-plants[a] | Demand | Balance |
| 1. Africa | 524 | 499,8 | + 24,2 | 1264 | 910,1 | + 353,9 |
| North-West Africa | - | | | - | | |
| West Africa | 176 | 180,0 | - 4,0 | 472 | 399,0 | + 73,0 |
| Ghana | - | 15,0 | | 40 | 34,0 | |
| Ivory Coast | 40 | 25,0 | | 80 | 80,0 | |
| Mali | - | 9,0 | | 40 | 15,0 | |
| Nigeria | 136 | 120,0 | | 272 | 210,0 | |
| Senegal | - | 11,0 | | 40 | 60,0 | |
| Central Africa | 160 | 47,2 | +112,8 | 280 | 77,5 | + 202,5 |
| Angola | 40 | 12,3 | | 80 | 25,0 | |
| Cameroon | 40 | 28,0 | | 80 | 39,0 | |
| Congo | 40 | 3,2 | | 40 | 7,0 | |
| Gabon | - | 0,3 | | 40 | 0,5 | |
| Zaire | 40 | 3,7 | | 40 | 6,0 | |
| East and Southern Africa | 188 | 272,6 | - 84,6 | 512 | 433,6 | + 78,4 |
| Burundi | 40 | 0,9 | | 40 | 2,3 | |
| Ethiopia | 40 | 35,0 | | 80 | 64,0 | |
| Madagascar | - | 5,9 | | 40 | 15,0 | |
| Malawi | 40 | 28,3 | | 80 | 40,3 | |
| Zambia | - | 72,5 | | 136 | 128,0 | |
| Zimbabwe | 68 | 130,0 | | 136 | 184,0 | |

Appendix 4/4

Table 1/cont'd/

| | 1990 | | | 2000 | | |
|---|---|---|---|---|---|---|
| | Capacity of mini-plants[a] | Demand | Balance | Total capacity of mini-plants[a] | Demand | Balance |
| 2. Latin America | 1004 | 3781,0 | -2777,0 | 2348 | 6478,0 | -4130,0 |
| Central America | 244 | 1449,5 | -1205,5 | 488 | 2040,0 | -1552,0 |
| Guatemala | 68 | 62,5 | | 136 | 105,0 | |
| Mexico | 136 | 1366,0 | | 272 | 1890,0 | |
| Panama | 40 | 21,0 | | 80 | 45,0 | |
| Carribean | 204 | 449,0 | - 245,0 | 408 | 666,0 | - 258,0 |
| Cuba | 136 | 392,0 | | 272 | 581,0 | |
| Dominian Rep. | 68 | 57,0 | | 136 | 85,0 | |
| South America | 556 | 1882,5 | -1326,5 | 1452 | 3772,0 | -2320,0 |
| Argentina | 80 | 75,0 | | 160 | 120,0 | |
| Brazil | 204 | 1300,0 | | 544 | 2844,0 | |
| Chile | 68 | 99,0 | | 204 | 162,0 | |
| Colombia | 68 | 195,0 | | 272 | 300,0 | |
| Equador | 136 | 66,5 | | 272 | 120,0 | |
| Peru | 68 | 147,0 | | 204 | 226,0 | |
| 3. Near East | 420 | 1950,0 | -1530,0 | 1152 | 2783,0 | -1631,0 |
| N.E.Africa | 108 | 904,0 | - 796,0 | 284 | 1300,0 | -1016,0 |
| Egypt | 68 | 823,0 | | 204 | 1120,0 | |
| Sudan | 40 | 81,0 | | 80 | 180,0 | |
| N.E. Asia | 312 | 1046,0 | - 734,0 | 868 | 1483,0 | - 615,0 |
| Afghanistan | 40 | 36,0 | | 120 | 83,0 | |
| Turkey | 272 | 1010,0 | | 748 | 1400,0 | |

Table 1/cont'd/

| | 1990 | | | 2000 | | |
|---|---|---|---|---|---|---|
| | Capacity of mini-plants [a] | Demand | Balance | Total capacity of mini-plants [a] | Demand | Balance |
| **4. Far East** | 3160 | 25172,0 | -22012,0 | 8176 | 40362,0 | -32186,0 |
| **South Asia** | 856 | 7442,0 | -6586,0 | 2392 | 15106,0 | -12714,0 |
| Bangladesh | 136 | 420,0 | | 340 | 910,0 | |
| India | 476 | 5660,0 | | 1292 | 11750,0 | |
| Nepal | 40 | 22,0 | | 80 | 46,0 | |
| Pakistan | 204 | 1340 | | 680 | 2400,0 | |
| **East and South-East Asia** | 2304 | 17730,0 | -15426,0 | 5784 | 25256,0 | -19472,0 |
| Burma | 136 | 143,0 | | 272 | 237,0 | |
| China | 1040 | 14231,0 | | 2400 | 19923,0 | |
| Indonesia | 340 | 1370,0 | | 884 | 2100,0 | |
| Korea DPR | 40 | 776,0 | | 120 | 850,0 | |
| Malaysia | 136 | 230,0 | | 476 | 346,0 | |
| Philippines | 340 | 350,0 | | 816 | 600,0 | |
| Thailand | 136 | 250,0 | | 340 | 480,0 | |
| Viet Nam | 136 | 380,0 | | 476 | 720,0 | |

a - unit capacity: 40 000 tpy N for 150tpd $NH_3$
68 000 tpy N for 250tpd $NH_3$

Appendix 4/4

Table 2

## Potential users of mini $P_2O_5$ fertilizer plants

/demand versus mini plants' capacities in countries identified as potential users of mini fertilizer plants/

1000 tpy $P_2O_5$

| Country | 1990 | | | 2000 | | |
|---|---|---|---|---|---|---|
| | Capacity of mini-plants[a] | Demand | Balance | Total capacity of mini-plants[a] | Demand | Balance |
| 1. Africa | 203 | 262.6 | -59,6 | 522 | 509,0 | +13,0 |
| North-West Africa | - | - | - | - | - | - |
| West Africa | 58 | 99,4 | -41,4 | 174 | 155,2 | +18,8 |
| Mali | 29 | 5,3 | | 29 | 10,2 | |
| Niger | - | 1,8 | | 29 | 2,3 | |
| Nigeria | 29 | 90,0 | | 87 | 140,0 | |
| Upper Volta | - | 2,3 | | 29 | 2,7 | |
| Central Africa | 29 | 11,1 | +17,9 | 87 | 17,8 | +69,2 |
| Angola | - | 7,2 | | 29 | 11,0 | |
| Centr.Afr.Rep. | 29 | 1,1 | | 29 | 2,3 | |
| Zaire | - | 2,8 | | 29 | 4,5 | |
| East and Southern Africa | 116 | 152,1 | -36,1 | 261 | 336,0 | -75,0 |
| Burundi | - | 0,9 | | 29 | 2,3 | |
| Kenya | - | 36,0 | | 29 | 90,0 | |
| Malawi | - | 9,0 | | 29 | 25,0 | |
| Tansania | 29 | 18,0 | | 29 | 39,0 | |
| Uganda | 29 | 1,2 | | 29 | 3,7 | |
| Zambia | 29 | 30,0 | | 29 | 61,0 | |
| Zimbabwe | 29 | 57,0 | | 87 | 115,0 | |

Table 2/cont'd/

| Country | 1990 | | | 2000 | | |
|---|---|---|---|---|---|---|
| | Capacity of mini-plants[a] | Demand | Balance | Total capacity of mini-plants[a] | Demand | Balance |
| 2. Latin America | 290 | 2087,0 | -1797,0 | 696 | 3556,0 | -2860,0 |
| Central America | 29 | 42,0 | - 13,0 | 58 | 71,0 | - 13,0 |
| Guatemala | 29 | 42,0 | | 58 | 71,0 | |
| Caribbean | 29 | 118,0 | - 89,0 | 87 | 190,0 | - 103,0 |
| Cuba | 29 | 118,0 | | 87 | 190,0 | |
| South America | 232 | 1927,0 | -1695,0 | 551 | 3295,0 | -2744,0 |
| Argentina | 29 | 66,0 | | 87 | 107,0 | |
| Brazil | 58 | 1600,0 | | 145 | 2740,0 | |
| Chile | 58 | 115,0 | | 116 | 188,0 | |
| Colombia | 58 | 120,0 | | 145 | 192,0 | |
| Equador | 29 | 26,0 | | 58 | 68,0 | |
| 3. Near East | 58 | 968,0 | - 910,0 | 174 | 1537,0 | -1363,0 |
| N.E. Africa | 29 | 195,0 | - 166,0 | 87 | 320,0 | - 233,0 |
| Egypt | 29 | 195,0 | | 87 | 320,0 | |
| N.E. Asia | 29 | 773,0 | - 744,0 | 87 | 1217,0 | -1130,0 |
| Turkey | 29 | 773,0 | | 87 | 1217,0 | |

Table 2/cont'd/

| Country | 1990 | | | 2000 | | |
|---|---|---|---|---|---|---|
| | Capacity of mini-plants[a] | Demand | Balance | Total capacity of mini-plants[a] | Demand | Balance |
| 4. Far East | 609 | 7192,0 | -6583,0 | 1653 | 12244,0 | -10591,0 |
| South Asia | 145 | 2580,0 | -2435,0 | 435 | 4830,0 | - 4395,0 |
| India | 87 | 2180,0 | | 261 | 4110,0 | |
| Pakistan | 58 | 400,0 | | 174 | 720,0 | |
| East and South--East Asia | 464 | 4612,0 | -4148,0 | 1218 | 7414,0 | - 6196,0 |
| China | 290 | 3812,0 | | 754 | 6100,0 | |
| Indonesia | 58 | 410,0 | | 174 | 580,0 | |
| Korea DPR | 29 | 190,0 | | 87 | 250,0 | |
| Viet Nam | 87 | 200,0 | | 203 | 484,0 | |

a - unit capacity: 29 000 tpy $P_2O_5$

For the guidance of our publications programme in order to assist in our publication activities, we would appreciate your completing the questionnaire below and returning it to UNIDO, Division for Industrial Studies, P.O. Box 300, A-1400 Vienna, Austria

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Mini-Fertilizer Plant Projects, Appendices

| | | (please check appropriate box) yes | no |
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| (2) | Was the analysis sound? | ☐ | ☐ |
| (3) | Was the information provided new? | ☐ | ☐ |
| (4) | Did you agree with the conclusion? | ☐ | ☐ |
| (5) | Did you find the recommendations sound? | ☐ | ☐ |
| (6) | Were the format and style easy to read? | ☐ | ☐ |
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